

163N Demineralization Plant Wastewater Stream-Specific Report

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management



Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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ABSTRACT

The 163N Demineralization Plant wastewater is characterized in terms of its chemical and radiological composition, discharge history, and sources of discharge. The subject stream is a dilute aqueous effluent derived from the production of high-quality water for coolant systems at N Reactor and the Washington Public Power Supply System Hanford Generating Plant. N Reactor and the 163N facility are located on the Hanford Site in southcentral Washington State. A process description of the 163N facility and sampling data are presented as a basis for the wastewater characterization. A designation pursuant to Washington State Dangerous Waste Regulations is also presented.*

This report supports an effort by the U.S. Department of Energy to provide the public with information about liquid discharges to the soil at the Hanford Site and to assess the potential for migration of contaminants from receiving sites of these liquid discharges.

**Washington Department of Ecology, 1989, Dangerous Waste Regulations, Washington (State) Administrative Code 173-303, Olympia, Washington.*

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EXECUTIVE SUMMARY

The 163N Demineralization Plant wastewater stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*.^{*} A combination of process knowledge and sampling data was used to determine a listed waste designation (WAC 173-303-080) for this stream. Sampling data alone are used to determine a designation based on dangerous waste characteristics (WAC 173-303-090) and dangerous waste criteria (WAC 173-303-100). Sampling data are based on two samples taken downstream of all process contributors between October 1989 and March 1990.

Included in this report is a description of the 163N facility and the demineralization process, in relation to sources of individual constituents of the 163N facility wastewater. It is concluded that the composition of the effluent as revealed by sampling data is consistent with process knowledge, in both the identities and concentrations of constituents present.

Further characterization efforts for the purpose of this effluent study are not warranted for this stream in light of the fact that the 163N facility is presently inactive.

^{*}Washington Department of Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code 173-303, Olympia, Washington.

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LIST OF TERMS

AA	atomic absorption spectroscopy
ALARA	as low as reasonably achievable
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
%CI	percent confidence interval
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy-Richland Operations Office
DRD	Defense Reactor Division
%EC	percent equivalent concentration
Ecology	Washington State Department of Ecology
ENU	elementary neutralization unit
EP	Extraction Procedure Toxicity Test
EPA	U.S. Environmental Protection Agency
GC	gas chromatography
HH	halogenated hydrocarbons
IARC	International Agency for Research on Cancer
ICP	inductively-coupled plasma spectroscopy
MS	mass spectrometry
NIOSH	National Institute of Safety and Health
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbons
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RQ	reportable quantity
TDS	total dissolved solids
TOC	total organic carbon
TOX	total organic halides
Tri-Party Agreement	<i>Hanford Federal Facility Agreement and Consent Order</i>
WAC	Washington Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company
wt%	weight percent

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163N DEMINERALIZATION PLANT WASTEWATER
STREAM-SPECIFIC REPORT

1.0 INTRODUCTION

This report characterizes the wastewater stream discharging from the 163N Demineralization Plant to the 1324NA Percolation Pond. This characterization consists of the following elements: a process description, sampling data, and a proposed wastestream designation based on dangerous waste regulations contained in the Washington Administrative Code (WAC) 173-303, (Ecology 1989), comparison to drinking water standards, and chemical loadings on the receiving site. New sampling data (October 1989 to March 1990) were used for the above purposes.

1.1 BACKGROUND

In response to the *Hanford Federal Facility Agreement and Consent Order*, (Tri-Party Agreement) (Ecology et al. 1989), comments were received from the public regarding reduction of the discharge of liquid effluents into the soil column. As a result, the U.S. Department of Energy (DOE), with the concurrence of the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), has committed to assess the contaminant migration potential of liquid discharges at the Hanford Site (Lawrence 1989).

This assessment is described in the *Liquid Effluent Study Project Plan* (WHC 1990a), a portion of which characterizes 33 liquid effluent streams. This characterization consists of integrating the following elements, pursuant to the Washington (State) Administrative Code, WAC 173-303 (Ecology 1989): process data, sampling data, and dangerous waste regulations.

The results of the characterization study are documented in 33 separate addenda, one per wastestream. The complete list of stream-specific addenda appears in Table 1-1. This addendum is one of the 33.

The 1324NA Percolation Pond has been the final receiving site for wastewater from the 163N Demineralization Plant since 1977.

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Table 1-1. Stream-Specific Report Reference List.

WHC-EP-0342 Addendum	1	300 Area Process Wastewater
WHC-EP-0342 Addendum	2	PUREX Plant Chemical Sewer
WHC-EP-0342 Addendum	3	N Reactor Effluent
WHC-EP-0342 Addendum	4	163N Demineralization Plant Wastewater
WHC-EP-0342 Addendum	5	PUREX Plant Steam Condensate
WHC-EP-0342 Addendum	6	B Plant Chemical Sewer
WHC-EP-0342 Addendum	7	UO ₃ /U Plant Wastewater
WHC-EP-0342 Addendum	8	Plutonium Finishing Plant Wastewater
WHC-EP-0342 Addendum	9	S Plant Wastewater
WHC-EP-0342 Addendum	10	T Plant Wastewater
WHC-EP-0342 Addendum	11	2724-W Laundry Wastewater
WHC-EP-0342 Addendum	12	PUREX Plant Process Condensate
WHC-EP-0342 Addendum	13	222-S Laboratory Wastewater
WHC-EP-0342 Addendum	14	PUREX Plant Ammonia Scrubber Condensate
WHC-EP-0342 Addendum	15	242-A Evaporator Process Condensate
WHC-EP-0342 Addendum	16	B Plant Steam Condensate
WHC-EP-0342 Addendum	17	B Plant Process Condensate
WHC-EP-0342 Addendum	18	2101-M Laboratory Wastewater
WHC-EP-0342 Addendum	19	UO ₃ Plant Process Condensate
WHC-EP-0342 Addendum	20	PUREX Plant Cooling Water
WHC-EP-0342 Addendum	21	242-A Evaporator Cooling Water
WHC-EP-0342 Addendum	22	B Plant Cooling Water
WHC-EP-0342 Addendum	23	241-A Tank Farm Cooling Water
WHC-EP-0342 Addendum	24	284-E Powerplant Cooling Water
WHC-EP-0342 Addendum	25	244-AR Vault Cooling Water
WHC-EP-0342 Addendum	26	242-A Evaporator Steam Condensate
WHC-EP-0342 Addendum	27	284-W Powerplant Wastewater
WHC-EP-0342 Addendum	28	400 Area Secondary Cooling Water
WHC-EP-0342 Addendum	29	242-S Evaporator Steam Condensate
WHC-EP-0342 Addendum	30	241-AY/AZ Tank Farm Steam Condensate
WHC-EP-0342 Addendum	31	209-E Laboratory Reflector Water
WHC-EP-0342 Addendum	32	T Plant Laboratory Wastewater
WHC-EP-0342 Addendum	33	183-D Filter Backwash Wastewater

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The 100N Area, where the 163N and 1324NA facilities are located, is at the north end of the Hanford Site adjacent to the Columbia River in eastern Washington State (Figure 1-1). The 163N facility is located south of N Reactor, the major structure of the 100N Area (Figure 1-2).

The process of producing demineralized water from raw river water involves six steps:

- Coagulation of dissolved organic species and suspended solids followed by filtration to remove the suspended floc before ion exchange
- Chlorination of the filtered water supply
- Ion exchange to remove dissolved solids
- Regeneration of the ion exchange resins as they become exhausted
- Neutralization of the resulting corrosive wastewater or spent regenerant
- Discharge of neutralized wastewater to the 1324NA facility.

These processes are discussed in Section 2.0, "Process Description," in greater detail.

1.1.1 Effluent Control Accomplishments

The 163N facility is operated in a manner that limits a potential release of hazardous material into the environment to as low as reasonably achievable (ALARA) levels. Personnel exposure to hazardous materials has been similarly limited. Since the time it was first operated, the 163N facility has undergone modifications that have decreased the volume and hazardous nature of wastewater leaving the plant.

Before 1977, the spent regenerant was discharged from the 163N facility to the Columbia River, as was common practice of industry at the time. The resulting dilution was relied on to mitigate the corrosive nature of this wastewater.

From 1977 to 1983, effluent from the 163N facility cation and anion regeneration cycles were combined with process and cooling waters from the 163N and discharged into north and south settling ponds and then into the adjacent 1324NA Percolation Pond. Additionally, the filter backwash water wastes from the 183N Filtration Plant were discharged into the north and south setting ponds. The solids in this waste stream settled out and the liquid portion was discharged into the 1324NA Percolation Pond.

In 1983 the 183N filter backwash was rerouted to a newly constructed backwash pond.

Figure 1-1. Geographical location of the 100N Area.

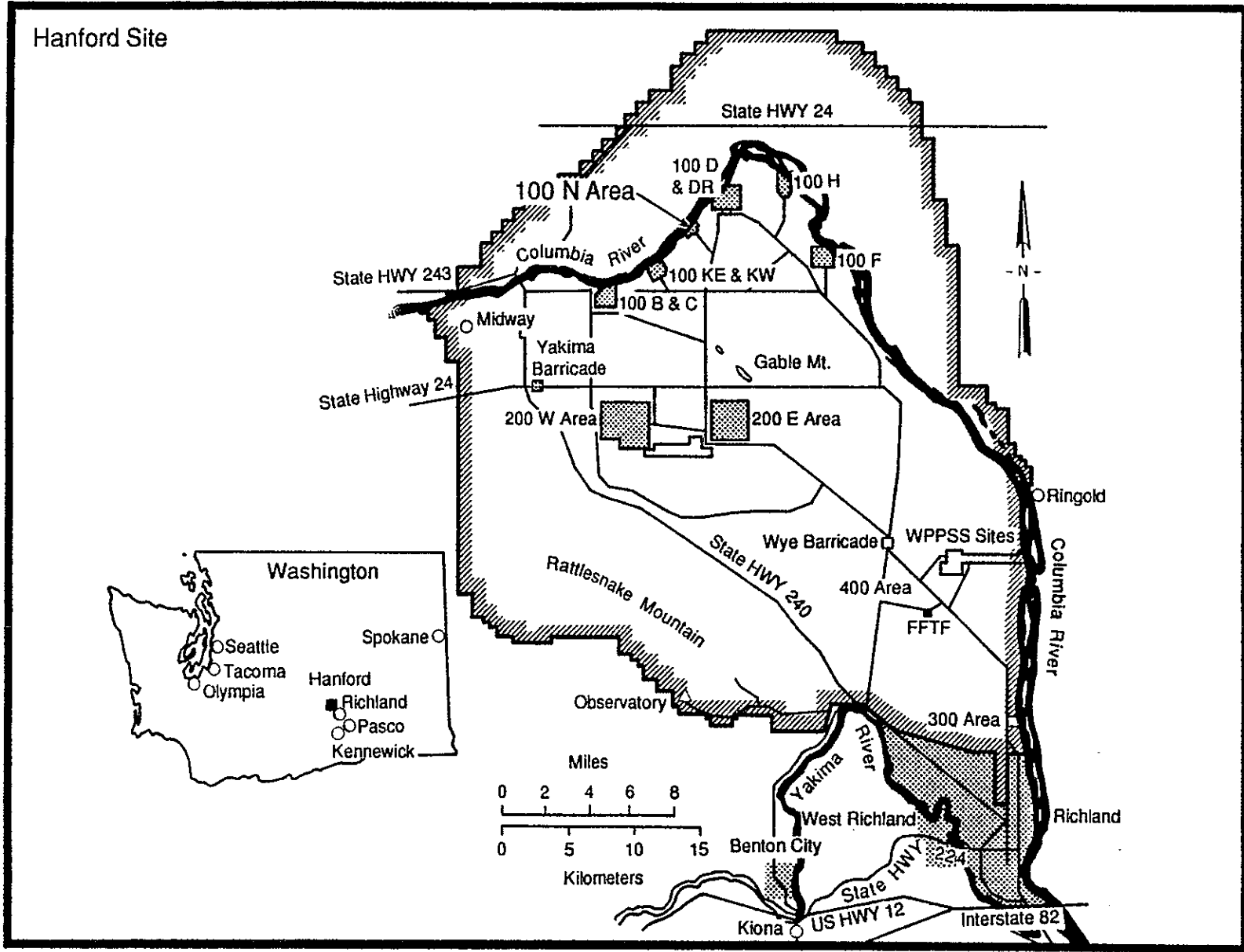
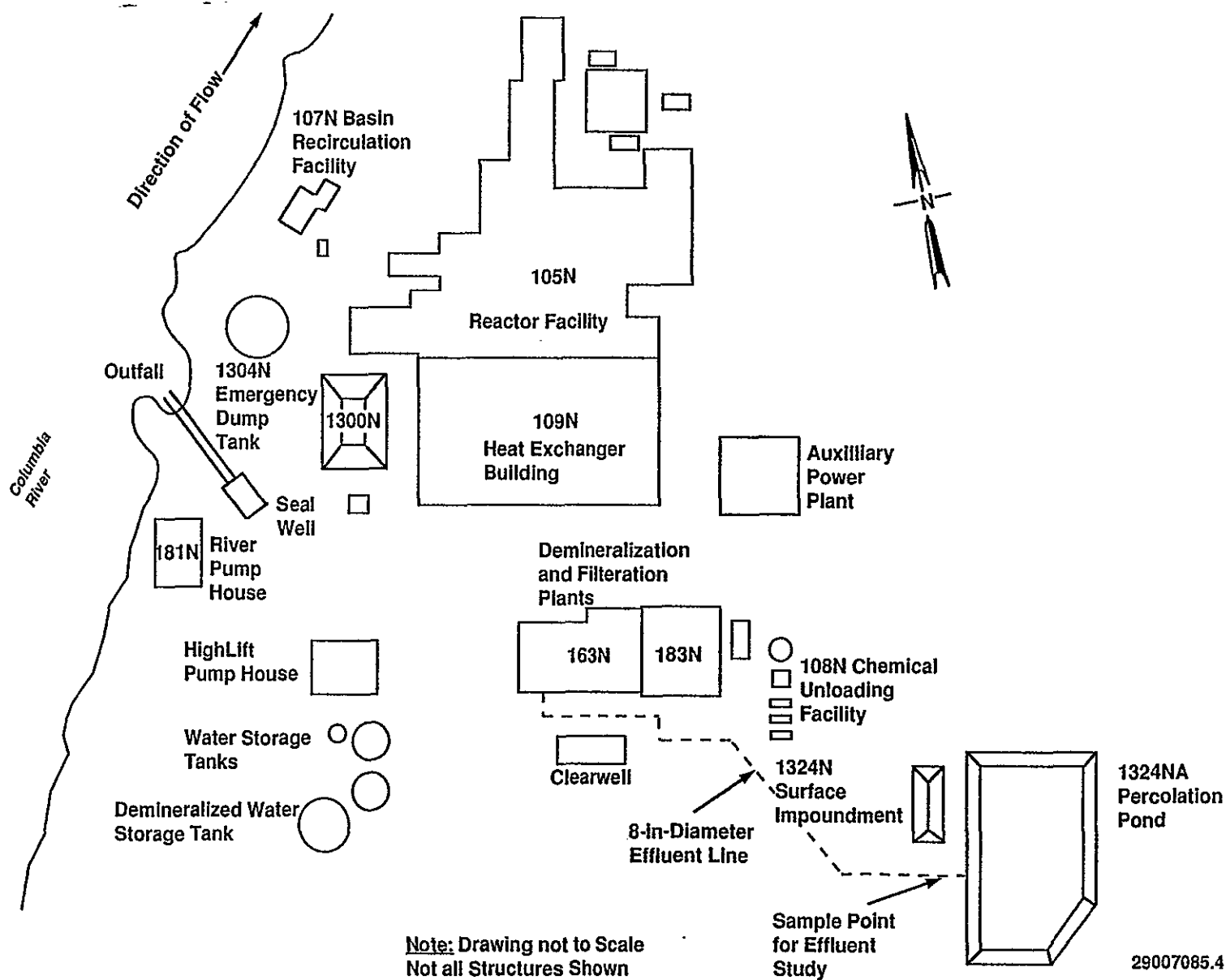


Figure 1-2. Map of 100N Area Showing the 163N Demineralization Plant's Relationship to Surrounding Facilities.



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In 1986 the north and south settling ponds, which were used for pH neutralization of the 163N facility spent regenerant, were replaced by the 1324N Surface Impoundment which consisted of a double liner and leachate collection system. The neutralization process involved treating individual batches with either sulfuric acid or sodium hydroxide, as appropriate. From the 1324N facility, the neutralized wastewater was then piped to the 1324NA facility for disposal.

In November 1988, use of the 1324N Surface Impoundment was discontinued when the newly constructed elementary neutralization unit (ENU), meeting the requirements of WAC 173-303, was put online at the 163N facility. The ENU neutralizes the spent regenerant before it leaves the plant, and does so with greater efficiency and operator control than had the 1324N facility.

1.1.2 Regulatory Aspects

A Dangerous Waste Part A Permit Application (WHC 1989a) for the 1324NA facilities was originally submitted to Ecology in 1986 by the U.S. Department of Energy, Richland Operations Office (DOE-RL), in accordance with the federal *Resource Conservation and Recovery Act* (RCRA).

More than 1 yr of RCRA groundwater monitoring at the site has been completed. Since a significant statistical difference between the upgradient and downgradient water quality has been observed, monitoring of this site has advanced into a more detailed assessment program.

The effluent from the 163N facility has been provided with upgraded effluent treatment by the installation of an ENU system (see Sections 1.1.1 and 2.1.3), therefore satisfying Tri-Party Agreement milestone M-17-00.

The 1324N facility was operated under RCRA interim status from 1986 through 1988. Since construction of the ENU, the 1324N facility has been inactive and is currently undergoing RCRA closure as part of the Tri-Party Agreement milestone M-20-35.

On December 5, 1988, a Notice of Intent was submitted to EPA, Region 10, with a request to reroute this neutralized wastestream back to the river (009) outfall. A formal National Pollutant Discharge Elimination System (NPDES) permit application revision is in progress. This action will help meet Tri-Party Agreement milestone M-17-10, requiring the elimination of liquid discharges to disposal units such as the 1324NA facility by June 1995.

1.2 APPROACH

This report characterizes 163N Demineralization Plant wastewater in sufficient detail to both support a wastestream designation, in accordance with WAC 173-303, *Dangerous Waste Regulations*, and provide information for WHC-EP-0367, *Liquid Effluent Study Final Project Report* (WHC 1990b).

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This characterization strategy (shown in Figure 1-3) is implemented by means of the following steps.

- Collect representative samples downstream from all contributors for chemical analysis.
- Describe both process knowledge and sampling data from October 1989 through March 1990 (Sections 2.0 and 3.0, respectively).
- Provide data overview (Section 4.0).
- Propose a designation (Section 5.0).
- Design an action plan, if needed, to obtain additional characterization data (Section 6.0).

1.3 SCOPE OF REPORT

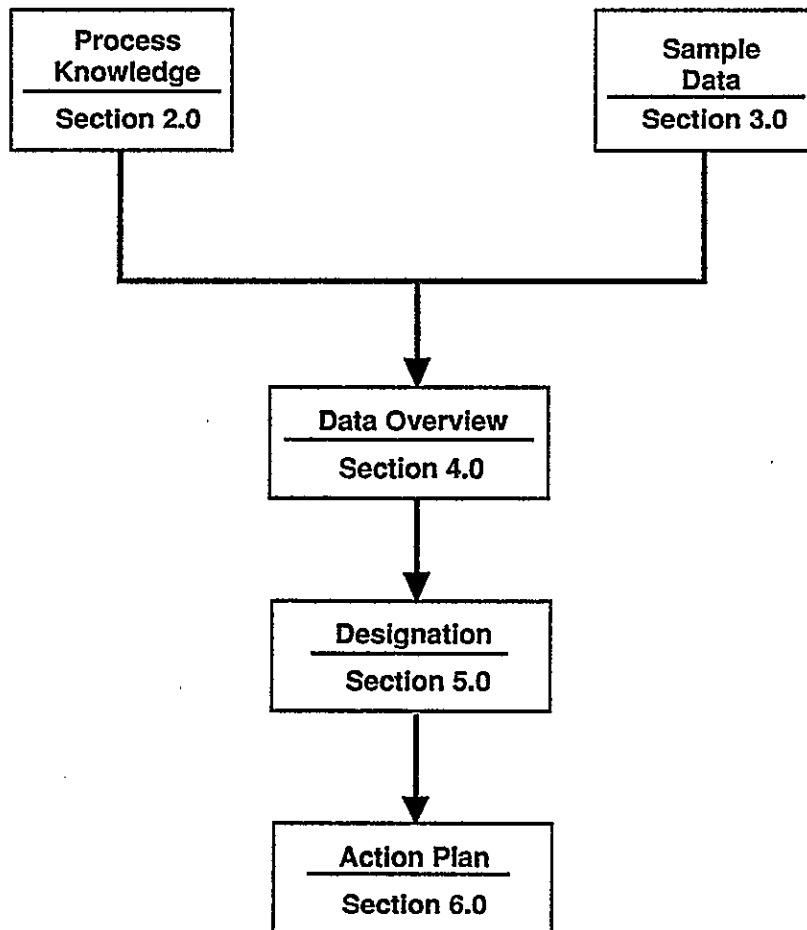
The 163N Demineralization Plant wastewater stream is defined for the purposes of this report as the wastewater stream from the 163N facility to the 1324NA facility. Reasons for defining the stream in this way follow:

- Water samples are currently collected at the point of discharge to 1324NA facility
- The 163N facility is the only source of wastewater discharged to the 1324NA facility
- The 1324NA facility is the only location at which potentially hazardous wastewater from the 163N facility can enter the ground.

The 163N facility wastewater stream is composed of intermittent batches of neutralized, spent regenerant, and a normal flow of steam condensate and filtered water. Both the normal flow from the 163N facility and the neutralized spent regenerant are routed from a sump on the north side of the 163N facility, via the same 8-in.-diameter effluent line, to the 1324NA facility. See Figure 1-2 for the sampling point used for this report and routing of the 8-in.-diameter effluent line.

The timeframe of this report is during a recent period of operation of the 163N facility, when sampling data (discussed in Section 3.0) were developed. This present sampling period is from October 1989 to March 1990; Appendix A presents this data. Sampling data representative of a previous period of operation, in 1988 and early 1989, are contained in Appendix B. Operation of the 163N facility was curtailed in April 1990 as a result of dry layup of N Reactor, with a corresponding reduction of discharges to the 1324NA facility.

Figure 1-3. Characterization Strategy.



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2.0 PROCESS KNOWLEDGE

This section presents a qualitative and quantitative characterization of the 163N Demineralization Plant wastewater, based on knowledge of the demineralization process. The process is discussed in terms of the following factors:

- Location and physical layout of the 163N facility
- A general description of the present, past, and future activities of the 163N facility
- The identity of the wastestream contributors
- The identity and expected concentration of each constituent of the wastestream.

2.1 PHYSICAL LAYOUT

The locations of facilities mentioned in this report, in relation to other structures in the 100N Area, are shown in Figure 1-2.

2.1.1 The 1324NA Percolation Pond

The 1324NA Percolation Pond is the current receiving site for neutralized spent regenerant from the 163N facility. Built in 1977, it received corrosive wastewater (i.e., untreated spent regenerant) directly from the 163N facility until 1986. In 1986, the 1324N Surface Impoundment was constructed to neutralize the regeneration wastestream before discharge to 1324NA. In 1988, the 1324N Surface Impoundment was replaced by the ENU. Since 1986, the 1324NA facility has not received corrosive wastewater, but has continued to receive 163N facility wastewater that has been pH-neutralized.

The 1324NA Percolation Pond is located approximately 1,000 m southeast of the 105N Reactor Facility (see Figure 1-2). It consists of a large, unlined earthen excavation. It receives wastewater from the 163N facility via an 8-in.-diameter effluent line. Present sampling efforts for this report were conducted at the outfall from the 8-in.-diameter effluent line into the 1324NA facility, downstream from all process contributors.

2.1.2 The 1324N Surface Impoundment

The 1324N Surface Impoundment was operated from May 1986 through November 1988. During this period, spent regenerant was neutralized in 1324N before discharge into the 1324NA facility.

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The 1324N facility flanks the west side of the 1324NA facility. It consists of a rectangular-shaped pond with sloping sides, with a double lining of plastic sheet and a leachate collection system to isolate pond contents from the soil column. The 1324N facility is designed to receive corrosive wastewater and to contain it safely while it is mixed with acid or caustic until neutralized, but it has not been used since November 1988.

In November 1988, the 1324N facility was replaced by an ENU meeting the requirements of WAC 173-303.

2.1.3 The 163N Demineralization Plant

The 163N facility, which supports N Reactor, demineralizes filtered water piped from the adjacent 183N filtration plant.

In order to understand the sources of various constituents found in the 163N facility wastewater stream, it is necessary to understand the basic components and terminology of the process.

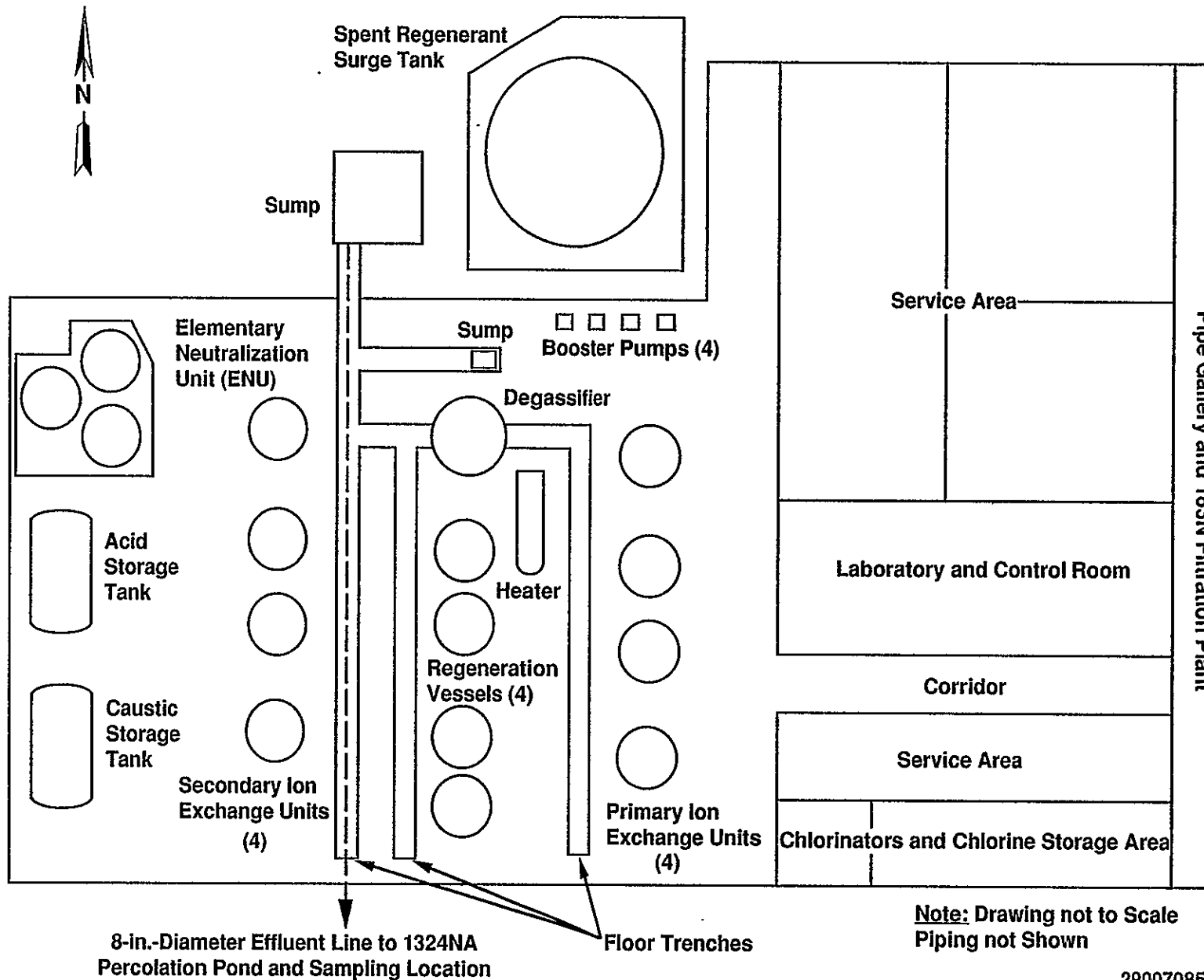
The purpose of the 163N facility is to produce high-quality, demineralized makeup water from filtered river water for the major coolant systems at N Reactor. Demineralized water has virtually all dissolved solids removed by a process called ion exchange, following initial filtration of Columbia River water in the adjacent 183N facility.

The importance of demineralized water in reactor operation is twofold. First, it helps to prevent mineral deposits that would otherwise eventually foul piping systems or lead to costly maintenance problems. Secondly, demineralized water limits the generation of radioactive waste during reactor operation. This waste is derived from dissolved or suspended, stable (i.e., nonradioactive) materials that become radioactive through neutron activation as the coolant circulates through the reactor core. Demineralization limits this process by preventing the introduction of new dissolved or suspended matter to the coolant.

The physical layout of the 163N facility is presented in Figure 2-1. The 163N facility contains demineralization equipment including ion-exchange units, regeneration tanks, treatment tanks (for pH adjustment) that are part of the ENU, acid and caustic storage tanks, a heater, and a degassifier. The spent regenerant surge tank and sump are located to the north and just outside of the 163N facility. The basic components of the plant and the demineralization process, and their role in the process, are described below.

Primary Cation Exchange Units--There are four primary cation exchange units, which are the top portions of four large vessels in the 163N facility. They contain ion exchange resins saturated with hydrogen ions to displace cation impurities (e.g., calcium, sodium, manganese, iron) in the water. At the same time, the displaced cations accumulate on the resins and the resins eventually become "exhausted," losing their capacity to absorb more cations. When this occurs, the resins are sent to a regeneration tank, where they are again saturated with hydrogen ions while the cation impurities are removed.

Figure 2-1. Generalized Floor Plan of the 163N Facility.



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Primary Anion Exchange Units--There are four primary anion exchange units, which are the bottom sections of the vessels that contain the primary cation exchange units. These primary anion units contain ion-exchange resins saturated with hydroxide ions. The hydroxide ions displace anion impurities (e.g., chlorides, fluorides, sulfates) in the water. The resins eventually become exhausted in the process and require regeneration.

Degassifier--Also referred to as the deaerator, this device uses heat and vacuum to remove noncondensable gases (e.g., nitrogen, oxygen) from the primary cation treated water. The degassifier has two vacuum systems: a steam jet air ejector system that uses medium pressure steam to create a vacuum, and a system that consists of three vacuum pumps. Condensed steam from the degassifier and heater is discharged to the sump via floor drain.

Heater--Also referred to as the heat exchanger, this device uses medium-pressure steam to warm up the water after it exits the primary cation units. The water must be heated to reduce the solubility of gasses in the water and make the degassifier more efficient.

Booster Pumps--There are four booster pumps, each rated at 600 gal/min, to increase the water pressure after it exits the degassifier. A small leakage from the gland seal packings of these pumps is discharged to the sump via floor drain.

Secondary Cation and Anion Exchange Units--There are four secondary cation units and four secondary anion units. These units are in four vessels in the top and bottom sections, respectively, in a manner similar to the primary units. The secondary units contain the same ion-exchange resins as the primary units. Their purpose is to remove any impurities remaining in the water following treatment in the primary units. Because the water treated in the secondary units has already been largely deionized in the primary units, the resins in the secondary units require regeneration less frequently.

Resin Trap--The resin trap removes any resins that may have escaped from the cation and anion exchange units, and it prevents the resins from entering the 163N facility wastewater. The resin trap is a series of screens through which the demineralized water flows.

Demineralized Water Storage Tank--This tank stores water from the 163N facility before the water is used at N Reactor. It is a 1-Mgal-capacity tank, located along with other water storage tanks southwest of the 163N facility (see Figure 1-2).

Regeneration Vessels--These are used to regenerate the cation and anion exchange resins when they become "exhausted," or saturated with ions and impurities. There are four regeneration vessels. The regeneration vessel for the primary cation units and the regeneration vessel for the primary anion units each have an upper compartment where regeneration occurs and a lower compartment where a spare resin charge is stored. The spare resin is sent

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to the primary unit at the same time as the depleted resin charge is sent to the regeneration vessel, allowing near-continuous operation of the primary units.

The regeneration vessels for the secondary cation and anion resins do not contain spare resins.

A sulfuric acid solution is used to regenerate cation resins, and a sodium hydroxide solution is used to regenerate the anion resins. The solutions are pumped through the resins in the regeneration vessels and drained to the spent regenerant surge tank.

Acid and Caustic Storage Tanks--Located along the west inside wall of the 163N facility, acid and caustic storage tanks contain solutions of sulfuric acid (H_2SO_4 , 93wt%) and sodium hydroxide (NaOH, 50wt%), respectively. These solutions are used to regenerate the resins and to neutralize the spent regenerant (i.e., the wastewater from regeneration). The storage tanks are surrounded by curbs for spill control. Any acid or caustic spills are recovered. The storage tanks are filled, as needed, through underground pipelines from larger tanks located at the 108N Chemical Unloading Facility east of 163N (see Figure 1-2).

Sump--The sump is located on the north side of the 163N facility. This structure receives liquid from the system of floor drains in the 163N facility. A valve in the recirculation line between the surge tank and the ENU allows neutralized wastewater to be discharged to the sump via a floor drain also. The sump discharges to the 8-in.-diameter effluent line (see Figure 1-2), which carries all wastewater to 1324NA from the 163N facility. This pipeline is routed along the bottom of a north-south running floor drain from the sump through the 163N facility to exit from its south wall (see Figure 2-1).

Spent Regenerant Surge Tank--The spent regenerant surge tank is located outside the 163N facility on its north side adjacent to the sump. It is designed to store spent regenerant until it can be neutralized in the ENU. During regeneration the surge tank discharges to the ENU system and is connected to the ENU by a recirculation line.

The spent regenerant is normally neutralized in the ENU and discharged to 1324NA via the sump. An alternate mode of operation allows the spent regenerant to be neutralized in the surge tank by recirculation and pH adjustment. Upon reaching proper pH limits, the neutralized wastestream is then discharged to the sump. The surge tank is surrounded by a curb for spill control, similar to the acid and caustic storage tanks.

Elementary Neutralization Unit--The ENU includes three upright tanks adjacent to the acid and caustic storage tanks inside the 163N facility. Spent regenerant is piped from the surge tank to the ENU. After adding the proper amount of acid or caustic solution, the tank contents are mechanically agitated to ensure mixing and pH neutralization. Neutralized spent regenerant is discharged from the ENU to the sump when its pH falls within the range

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from 6.0 to 9.0. Spent regenerant having a pH outside this range is piped back to the surge tank until it can receive additional treatment in the ENU. The ENU is surrounded by a curb, for spill control.

2.1.4 Other Facilities

The 183N Filtration Plant, which is located next to the 163N facility (in a connecting building), supplies the filtered and potable water needs of the 100N Area. Filtered water is used for producing demineralized water.

In the 183N facility, raw water from the Columbia River is treated with chlorine gas (a biocide) and alum (a coagulant) in a mixing tank. From there, it is piped to a coagulator, where polyacrylamide is added as a coagulation aid, and then piped to the sand filters where actual filtration takes place. The filtered water is pumped to a filtered water storage tank from a clearwell south of the 163N facility.

The filtration process removes suspended solids and most organic matter from the raw water supply. Some cations, including calcium, are somewhat diminished in concentration during filtration, and chloride (from chlorination) and sulfate (from alum addition) are somewhat increased in concentration. Other than these minor changes, the filtered water has an ionic composition similar to the raw water supply. The chlorination of filtered water also introduces traces of chloroform (trichloromethane) produced by the reaction of chlorine gas with low-molecular-weight organic constituents of the raw water.

2.2 CONTRIBUTORS

The 163N facility wastewater stream is a chemical wastestream. The major contributors of waste to the stream are dissolved ions removed from the filtered Columbia River water during the demineralization process.

The 163N facility has two operating configurations, normal and regeneration. During normal or "bypass" operation, no waste is being discharged from the regeneration of ion-exchange units. In this mode, chlorinated filtered water is used for backwashing the resin bed, resin transfer, and other operations listed in Table 2-1. This configuration is shown in block diagram form in Figure 2-2.

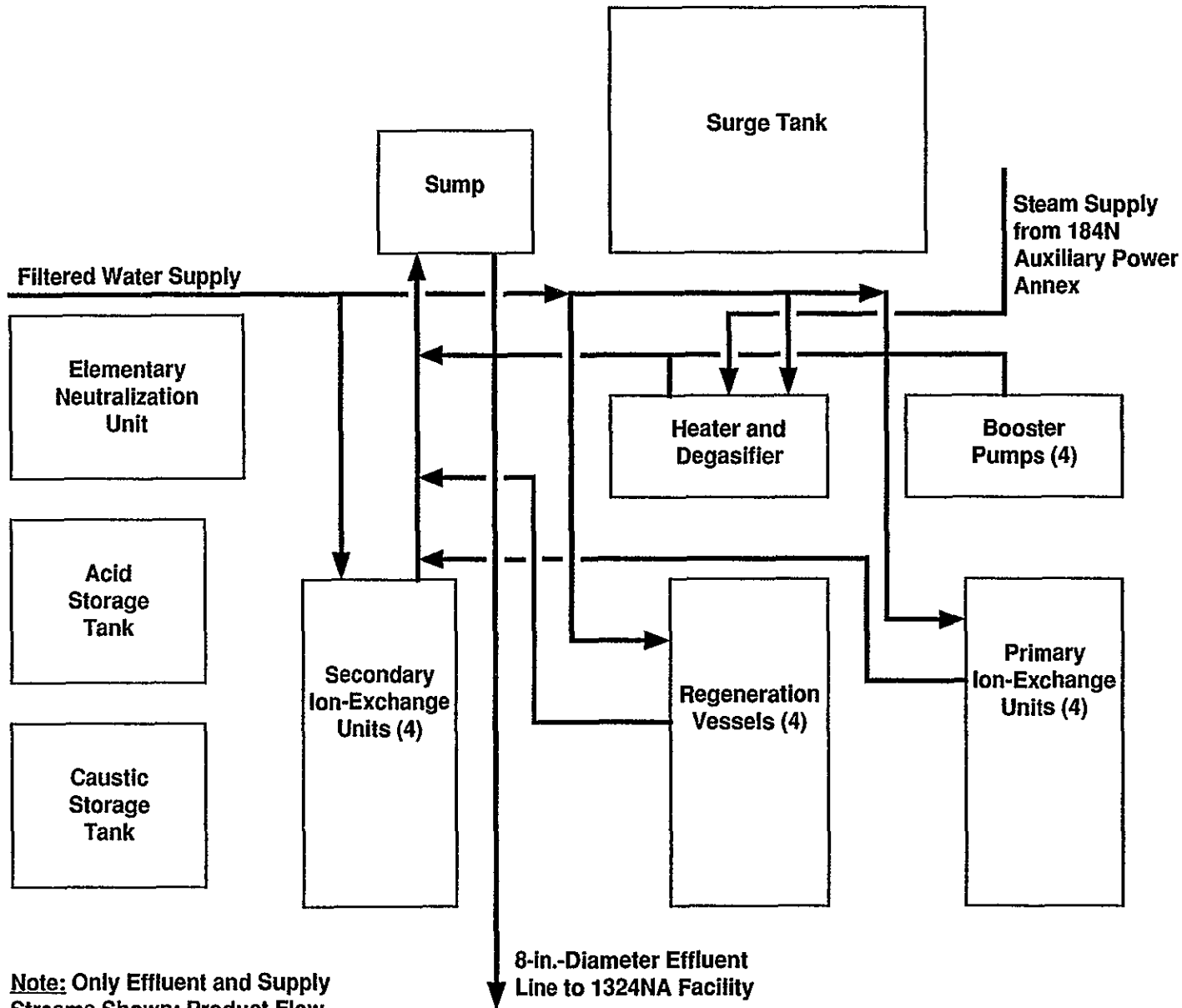
The discharge to the 1324NA facility during normal operation consists of flows resulting from operations listed in Table 2-2, in addition to steam condensate from the heater and a small leakage from the gland seal packings of the booster pumps. Therefore, the wastestream from this configuration consists primarily of chlorinated filtered water with a small percentage of the total flow being contributed by steam condensate and demineralized water. The demineralized water is highly purified, with most dissolved solids removed from the filtered water supply feed. The steam system in the 184N Auxiliary Power Annex, which supplies the 163N facility, used demineralized water with hydrazine (in the range of a few ppb) added as an oxygen scavenger for corrosion control.

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Table 2-1. Normal or "Bypass" Effluent Flows.

Operation	Primary units			Secondary units		
	Time (min)	Flow (gal/min)	Volume (gal)	Time (min)	Flow (gal/min)	Volume (gal)
Bypass flows						
Fluffing	2	350	700	2	350	700
Diffuser blowdown	5	350	1,750	5	350	1,750
Transfer out	15	350	5,250	15	300	4,500
Bottom flush	28	250	7,000	20	250	5,000
Transfer in	15	300	4,500	16	350	5,600
Bottom flush	24	250	6,000	20	250	5,000
Bed settling	4	150	600	4	150	600
Bed leveling	4	300	1,200	7	350	2,450
Backwash	23	200	4,500	15	200	3,000
Total bypass (gal for each regeneration)	31,5000			28,600		
Regenerations/mo	8			2		
Total volume (gal/mo)	252,000			57,200		

Figure 2-2. Flow Diagram of Wastestream Contributors During Normal or "Bypass" Operational Configuration



Note: Only Effluent and Supply Streams Shown; Product Flow Not Shown

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Table 2-2. Demineralized Water Demand and Regeneration Frequency.

ACTIVITY	Past		Present	Future
Applicable period	Before October 1989		October 1989 to March 1990	After March 1990
N Reactor Status	Full production	Cold-wet standby	Transition to dry layup	
Dates	Before January 1987	January 1987 to October 1989	October 1989 to March 1990	After March 9 1990
163N Operations				
• Average demand (gal/min)	1,300	650	300	Very low
• Regenerations/mo				
Primary cation	45	10	5	a
Secondary cation	1.3	1	1	a
Primary anion	15	5	3	a
Secondary anion	1.3	1	1	a

^a Ion-exchange units operated intermittently.

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In the regeneration configuration of the plant, neutralized spent regenerant from regeneration of the ion-exchange units is discharged in addition to these normal operational flows. The regeneration process is explained in Section 2.1.3. During regeneration, the normal or "bypass" flows generally continue to be discharged, along with spent regenerant. Figure 2-3 shows the wastestream contributors during regeneration; normal contributor streams are not included, as these are shown in Figure 2-2.

2.3 PROCESS DESCRIPTION

The process description has been segregated into three periods:

- Past Activities: Before October 1989
- Present Activities: October 1989 to March 1990
- Future Activities: After March 1990.

These operating periods are discussed in the following sections and summarized in Table 2-2.

2.3.1 Present Activities (October 1989 to March 1990)

N Reactor did not operate during the present sampling period. The discharges to the 1324NA were highly variable as a result of varying frequency of resin regeneration. The demand for high-quality water generally decreased during this period as the N Reactor systems progressed from cold-wet standby to dry layup status. These changes are reflected in Table 2-2.

The two operating configurations of the 163N facility, for sampling purposes, were called the "ion exchanger regeneration" and "bypass" configurations. During the sampling period, only the bypass configuration was sampled. The sample point and effluent line from 163N are shown in Figure 1-2.

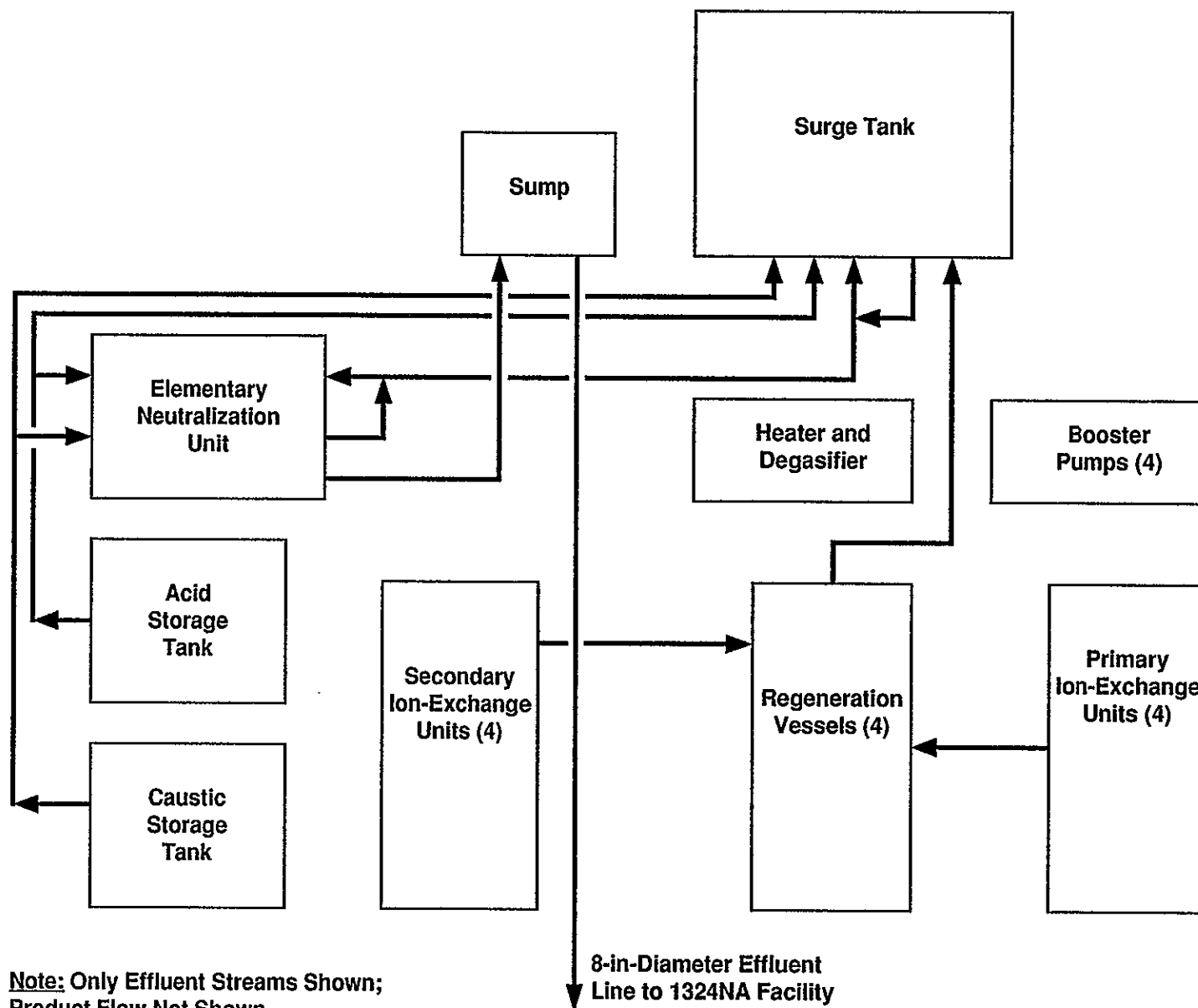
Since dry layup of N Reactor was initiated in October 1989, water demand has decreased to such an extent that the demineralization plant was operated at reduced capacity during most of the period between October 1989 and March 1990, and the average demineralized water demand for the 100N Area was 300 gal/min during that period.

The frequency of regeneration for the 163N Demineralization Plant as a function of 100N Area demineralized water demand is presented in Table 2-2.

2.3.2 Past Activities

A summary of 100N Area demineralized water demand and the corresponding frequency of regeneration (as dependent on reactor status) is given in Table 2-2.

Figure 2-3. Flow Diagram of Wastestream Contributors During Regeneration Configuration



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N Reactor has not operated since January 1987. During full reactor operation, the 163N facility was operated at an average output of 1,300 gal/min, with a peak capacity of 2,000 gal/min. Two of the primary ion-exchange units required regeneration each day (either two cation units, or one cation unit and one anion unit). All eight of the secondary units were regenerated in one sequence about every 3 mo.

Between January 1987 and October 1989, N Reactor was on cold-wet standby status. Under these conditions, primary ion-exchange units were being regenerated about every 2 days. The secondary units were regenerated about every 4 mo. This condition produced less than half the monthly volume of waste produced during full operation.

2.3.3 Future Activities (After March 1990)

The 163N facility continued to be operated intermittently from March 1990 to August 1990. At present the facility is out of service. All discharge from the 163N facility to 1324NA is expected to cease when resins are removed. Future actions planned to support Tri-Party Agreement milestones are discussed in Section 1.1.2.

2.4 PROCESS DATA

Both the regeneration and normal ("bypass") configurations were operating during the sampling period for this report (October 1989 to March 1990). With the random nature of the present sampling, only the bypass configuration was represented in samples collected.

Table 2-1 reflects operations using filter water in the normal configuration and quantities of wastewater generated. The total discharge to the 1324NA facility in the normal configuration was approximately 309,200 gal/mo, or an average of less than 8 gal/min. This flow rate is used to calculate deposition rates in Section 4.2.

Chemical constituents in 163N Demineralization Plant effluent between October 1989 and March 1990 are essentially the same as those found in the filtered water supply. The filtered water composition, in turn, largely reflects that of the raw Columbia River water (except for suspended solids and organic matter, which are removed by filtration), and the composition of this raw water is presented in Table 2-3. The raw water analysis shown is for 200 East Area raw water from a recent time frame (1986 to 1987). This water is pumped from the river near the abandoned B Reactor, upstream from the 100N Area. No similar analysis exists for the actual 100N Area raw water supply, and this analysis is assumed to be representative.

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Table 2-3. Summary of 200 East Area Raw Water.

Constituent/parameter	N ^b	Raw water ^a (1986-1987)	
		Average	Standard deviation
Barium	5	2.80 E+01	3.40 E+00
Cadmium	5	2.40 E+00	8.94 E-01
Calcium	5	1.84 E+04	1.47 E+03
Chloride	5	8.71 E+02	2.37 E+03
Conductivity, field (μS)	5	9.32 E+01	4.61 E+01
Copper	5	1.06 E+01	1.34 E+00
Iron	5	6.36 E+01	2.57 E+01
Magnesium	5	4.19 E+03	4.83 E+02
Manganese	5	9.80 E+00	3.49 E+00
Nickel	5	1.04 E+01	8.94 E-01
Nitrate (as N)	5	9.96 E+02	8.79 E+02
pH (dimensionless)	5	7.41 E+00	1.18 E+00
Potassium	5	7.95 E+02	6.24 E+01
Sodium	5	2.26 E+03	2.42 E+02
Sulfate	5	1.06 E+04	9.97 E+02
Temperature, field (°C)	5	1.64 E+01	5.84 E+00
TOC	5	1.36 E+03	2.53 E+02
Trichloromethane	5	1.18 E+01	4.02 E+00
Uranium	4	7.26 E-01	2.22 E-01
Zinc	5	2.00 E+01	2.12 E+01
Radionuclides (pCi/L)			
Alpha activity	4	8.85 E-01	5.30 E-01
Beta activity	4	4.47 E+00	1.76 E+00

NOTE: Measurements are in ppb except where noted.

^aCompiled from Substance Toxicity Evaluation of Waste Data Base; an update of the data presented in *Preliminary Evaluation of Hanford Liquid Discharges to Ground* (Jungfleisch 1988).

^bN is defined as the number of test results available for a particular analyte; N may reflect both single and multiple data sets.

TOC = total organic carbon

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3.0 SAMPLING DATA

This section provides the analytical test results from the sampling conducted between October 1989 and March 1990 pertaining to the 163N Demineralization Plant wastewater.

3.1 DATA SOURCE

The analyses conducted on the 163N facility wastewater samples are listed in Table 3-1. The resulting data, found in Appendix A and WHC-EP-0355 (WHC 1990f), fall into two distinct categories, chemical and radiological. Chemical data are expressed in terms of parts per billion (ppb) of a given constituent. Exceptions are noted and include pH, conductivity (in units of microSiemens), and field temperature (in degrees Celsius). Radiological data are expressed in picoCuries per liter (pCi/L). Alpha and beta activities measured are indicators of natural background radiation found in the river water. The samples taken for chemical analysis were submitted to the contract laboratory and analyzed in accordance with methods detailed in the EPA publication SW-846 (EPA 1986). The contract laboratory only reports values above contracted minimum detection levels, which differ among the various analytes.

The time spanned by the above sampling represents a period of decreasing demineralized water demand as N Reactor progressed from cold-wet standby to dry layup. Samples were collected at the outfall of the 8-in.-diameter effluent line to the 132NA facility, downstream from all contributors, as described in a previous effluent study (WHC 1989b).

3.2 DATA PRESENTATION

The chemical data from the period between October 1989 and March 1990 is from analyses listed in Table 3-1 and includes pH values and the concentrations of hydrazine, cations, anions, and volatile and semivolatile organic compounds. These data represent two samples, and are summarized in Table 3-2. Additional sampling data, covering a period beginning before October 1989, are previously published (WHC 1989b) and are presented in Appendix B. Additional sampling data, after March 1990, are discussed in Section 6.1.

Data reported by the laboratory under the primary sample number (see Section 3.0) are listed in Appendixes A and B with the primary sample number. Data for VOA blanks are listed in the data reported by the primary sample number and the suffix "B." Data for VOA transfer blanks are listed in the Extraction Procedure Toxicity Testing (listed as EP Toxic in the tables), ignitability testing, reactivity testing, and laboratory measurements of pH and conductivity are listed in the data reports by the primary sample number with the suffix "E" (for "extract," a term only applicable to the EP Toxicity Testing portion).

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Table 3-1. Procedures for 163N Demineralization Bypass
Effluent Samples. (sheet 1 of 2)

LEAD# CofC#	50869 50869	50923 50923
Alkalinity	X	X
Alpha counting	X	
Ammonia	X	X
Arsenic	X	X
Atomic emission spectroscopy	X	X
Beta counting	X	
Conductivity-field	X	X
Cyanide	X	X
Direct aqueous injection (GC)	X	X
Fluoride (LDL)	X	X
Gamma energy analysis	X	
Hydrazine	X	X
Ion chromatography	X	X
Lead	X	X
Mercury	X	X
pH-field	X	X
Selenium	X	X
Semivolatile organics (GC/MS)	X	X
Sulfide	X	X
Suspended solids	X	X
Temperature-field	X	X
Thallium	X	X
Total carbon	X	X
Total dissolved solids	X	X
Total organic carbon	X	X
Total organic halides (LDL)	X	X
Total radium alpha counting	X	
Uranium	X	
Volatile organics (GC/MS)	X	X
LEAD# CofC#	50869B 50870	50923B 50924
Volatile organics (GC/MS)	X	X
LEAD# CofC#	50869T 50871	50923T 50925
Volatile organics (GC/MS)	X	X

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Table 3-1. Procedures for 163N Demineralization Bypass
Effluent Samples. (sheet 2 of 2)

LEAD# CofC#	50869E 50872	50923E 50926
Atomic emission spectroscopy	X	X
Ignitability	X	X
Mercury (mixed matrix)	X	X
Reactive cyanide	X	X
Reactive sulfide	X	X

NOTE: Procedures that were performed for a given sample are identified by an "X." Procedure references appear with the data.

Sample number suffixes:

B = blank

E = extract

T = transfer blank

CofC# = chain-of-custody number

GC = gas chromatography

LEAD# = liquid effluent analytical data number that appears in the data reports

LDL = low-detection limit

MS = mass spectrometry

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Table 3-2. Statistical Summary for Bypass Configuration.
(sheet 1 of 2)

Constituent	N ^a	MDA ^b	Method ^c	Mean value (ppb)	Standard error (ppb)	90%CI limit ^d (ppb)	Maximum ^e (ppb)
Arsenic (EP Toxic)	2	2	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Barium	2	0	NA	2.25 E+01	2.50 E+00	3.02 E+01	2.50 E+01
Barium (EP Toxic)	2	2	NA	<1.00 E+03	0.00 E+00	<1.00 E+03	<1.00 E+03
Boron	2	0	NA	2.85 E+01	1.55 E+01	7.62 E+01	4.40 E+01
Cadmium (EP Toxic)	2	2	NA	<1.00 E+02	0.00 E+00	<1.00 E+02	<1.00 E+02
Calcium	2	0	NA	1.42 E+04	1.10 E+03	1.76 E+04	1.53 E+04
Chloride	2	0	NA	1.25 E+03	1.50 E+02	1.71 E+03	1.40 E+03
Chromium (EP Toxic)	2	2	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Fluoride	2	0	NA	1.70 E+02	4.00 E+00	1.82 E+02	1.74 E+02
Lead (EP Toxic)	2	2	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Magnesium	2	0	NA	3.44 E+03	2.55 E+02	4.23 E+03	3.70 E+03
Mercury (EP Toxic)	2	2	NA	<2.00 E+01	0.00 E+00	<2.00 E+01	<2.00 E+01
Nitrate	2	1	DL	5.00 E+02	0.00 E+00	5.00 E+02	5.00 E+02
Potassium	2	0	NA	5.11 E+02	2.70 E+01	5.94 E+02	5.38 E+02
Selenium (EP Toxic)	2	2	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Silicon	2	0	NA	1.86 E+03	1.00 E+02	2.17 E+03	1.96 E+03
Silver (EP Toxic)	2	2	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Sodium	2	0	NA	1.69 E+03	9.00 E+01	1.97 E+03	1.78 E+03
Strontium	2	0	NA	6.60 E+01	4.00 E+00	7.83 E+01	7.00 E+01
Sulfate	2	0	NA	1.58 E+04	1.55 E+03	2.06 E+04	1.74 E+04
Zinc	2	0	NA	1.20 E+01	1.00 E+00	1.51 E+01	1.30 E+01
Ammonia	2	0	NA	2.36 E+02	7.60 E+01	4.70 E+02	3.12 E+02
Hydrazine	2	1	DL	5.90 E+01	2.90 E+01	1.48 E+02	8.80 E+01
Trichloromethane	2	0	NA	1.10 E+01	0.00 E+00	1.10 E+01	1.10 E+01
Alkalinity (method B)	2	0	NA	3.90 E+04	2.00 E+03	4.52 E+04	4.10 E+04
Beta activity (pCi/L)	1	0	NA	2.85 E+01	NA	NA	2.85 E+01
Conductivity (μS)	2	0	NA	1.32 E+02	1.05 E+01	1.65 E+02	1.43 E+02
Ignitability (°F)	2	0	NA	2.09 E+02	3.00 E+00	2.00 E+02	2.06 E+02
pH (dimensionless)	2	0	NA	6.35 E+00	1.00 E-01	6.04 E+00	6.25 E+00
Reactivity cyanide (mg/kg)	2	2	NA	<1.00 E+02	0.00 E+00	<1.00 E+02	<1.00 E+02
Reactivity sulfide (mg/kg)	2	2	NA	<1.00 E+02	0.00 E+00	<1.00 E+02	<1.00 E+02
TDS	2	0	NA	4.70 E+04	1.10 E+04	8.09 E+04	5.80 E+04

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Table 3-2. Statistical Summary for Bypass Configuration.
(sheet 2 of 2)

Constituent	N ^a	MDA ^b	Method ^c	Mean value (ppb)	Standard error (ppb)	90%CI limit ^d (ppb)	Maximum ^e (ppb)
Temperature (°C)	2	0	NA	2.27 E+01	4.00 E-01	2.39 E+01	2.31 E+01
Total carbon	2	0	NA	1.54 E+04	1.40 E+03	1.97 E+04	1.68 E+04
TOX (as Cl)	2	0	NA	4.30 E+01	5.00 E+00	5.84 E+01	4.80 E+01
¹³⁷ Cs (pCi/L)	1	0	NA	1.29 E+01	NA	NA	1.29 E+01

NOTE: Measurements are in ppb except where noted.

^aN = Number--the total number of results in each data set reported for this stream configuration.

^bMDA = minimum detectable amount--the number of results in each data set below the detection limit.

^cMethod = replacement method used:

DL = replacement by the detection limit

LM = replacement of single-valued MDAs by the log-normal plotting position method

MR = replacement of multiple valued MDAs by the normal plotting position method

NA = not applicable.

^d90%CI limit = 90% confidence interval limit--the lower limit of the one-tailed 90% confidence interval for all ignitability data sets and pH data sets with mean values below 7.25. For all other data sets it is the upper limit of the one-tailed 90% confidence interval.

^eMaximum = the minimum value in the data set for ignitability, the value furthest from 7.25 for pH, and the maximum value for all other analytes.

EP = Extraction Procedure Toxicity Test

TDS = total dissolved solids

TOX = total organic halides

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4.0 DATA OVERVIEW

This section presents a comparison of the process knowledge data (Section 2.0) with sampling data (Section 3.0) to determine the identity and concentration levels of the chemical analytes present in the 163N Demineralization Plant effluent.

4.1 DATA COMPARISON

A comparison of the two sets of characterization data is presented in Table 4-1. The process estimates are assumed to reflect the ion content of raw Columbia River water. As a result of the normal or "bypass" configuration of the plant during the period of sampling, the liquid sampled is mainly filtered water, with a small amount of steam condensate from the heater and degassifier, and an additional small leakage of demineralized water from the gland seal packings of the booster pumps mixed in. Filtered water has essentially all of the dissolved inorganic species found in the raw water supply at similar concentrations (although in some cases [e.g. calcium] somewhat reduced). Two ionic species, chloride and sulfate, are increased during the filtration process as a result of chlorination and flocculation, respectively. Because raw water data from Table 2-3 is more complete than available filtered water data in terms of the number of inorganic analytes represented, and as a result of the similarity of test methods used on the raw water to those used on the effluent samples, this data is used for the purpose of comparison with sampling data.

The comparison shown in Table 4-1 is a ratio, for each analyte, of process to sampling data. As expected, concentrations predicted based on the composition of raw Columbia River water are in every case within one order of magnitude of actual analysis, and in most cases are within a multiple of two. This comparison reflects the fact that the raw water content of chloride and sulfate are added to during filtration, while some cations such as calcium are decreased. This finding correlates with the fact that the normal or "bypass" flow consists largely of filtered river water.

In the case of beta activity, the discrepancy between sampling data and process estimate, while within one order of magnitude, is more pronounced than for all the other analytes. There is no source of radiological contamination entering the process (other than natural background radioactivity in the raw water and natural thorium present in alum, which is used in the filtration process). This discrepancy cannot be explained, other than by pointing out that the beta activity in the sampling data is based on only one detection out of two samples, and is probably a statistical artifact.

One compound not predicted from process knowledge is hydrazine, which comes from the small percentage of steam condensate contributing to the wastewater. The steam supplied to the 163N facility comes from an oil-fired steam plant (184N facility) adjacent to N Reactor, and hydrazine is used as an oxygen scavenger to prevent corrosion in carbon steel piping systems. No other notable impact on the data is seen from this minor contributor.

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Table 4-1. Comparison of Process and Sampling Data.

Analyte	Process estimate ^a	Sampling data ^b			Ratio ^c	
		Average	Minimum	Maximum		
Cations (ppb)						
Barium	2.80 E+01	2.25 E+01	1.48 E+01	3.02 E+01	1.24	
Calcium	1.84 E+04	1.42 E+04	1.08 E+04	1.76 E+04	1.30	
Magnesium	4.19 E+03	3.44 E+03	2.65 E+03	4.23 E+03	1.22	
Potassium	7.95 E+02	5.11 E+02	4.28 E+02	5.94 E+02	1.56	
Sodium	2.26 E+03	1.69 E+03	1.41 E+03	1.97 E+03	1.34	
Zinc	2.00 E+01	1.20 E+01	8.90 E+00	1.51 E+01	1.67	
Anions (ppb)						
Chloride	8.71 E+02	1.25 E+02	1.25 E+03	7.90 E+02	0.70	
Nitrate	9.96 E+02	5.00 E+02	--	--	1.99	
Sulfate	1.06 E+04	1.58 E+04	1.10 E+04	2.06 E+04	0.67	
Radiological (pCi/L)						
Alpha activity	8.85 E-01	0.00 E+00	--	--	--	
Beta activity	4.47 E+00	2.85 E+00	--	--	0.16	
Other						
Conduction (μS)	9.32 E+01	1.32 E+02	9.90 E+01	1.65 E+02	0.71	
Chloroform (ppb)	1.18 E+01	1.10 E+01	1.10 E+01	1.10 E+01	1.07	
Hydrazine (ppb)	(low)	5.90 E+01	0.00 E+00	1.48 E+02	--	

^aProcess estimate from Section 2.4.

^bSampling data from Table 3-2.

^cRatio of process estimate to sampling data (average).

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The neutralized spent regenerant, which intermittently forms the bulk of the 163N facility wastewater during the regeneration configuration, can be expected to be similar to filtered water in composition except that concentrations are higher. This is because the ion exchange resins, which remove ions from the filtered water during demineralization, are stripped of those ions during regeneration. Previous analyses of the spent regenerant show ionic concentrations to be about ten times those found in the raw Columbia River water, with somewhat higher concentrations of sulfate and sodium contributed by the acid and caustic solutions used for regeneration. Deposition rates during this configuration would be increased.

Table 4-2 provides a comparison of average constituent concentrations to various screening criteria. These criteria are not used here for compliance purposes, but for comparison only, and are explained in the footnotes to the table.

4.2 STREAM DEPOSITION RATES

Table 4-3 shows hypothetical deposition rates representative of the normal or "bypass" configuration using the mean concentrations from Table 3-2 and an average 163N facility discharge of 8 gal/min (Section 2.4).

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Table 4-2. Comparison of 163N Demineralization Plant Effluent Concentrations to Various Screening Criteria.

Constituent	Result (mg/L) ^a	SV1 (mg/L) ^b	SV2 (mg/L) ^c
Barium	2.2 E-02	5.0 E+00 ^{b.1}	
Chloride	1.2 E+00	2.5 E+02 ^{b.2}	
Fluoride	1.7 E-01	2.0 E+00 ^{b.1}	
Nitrate	5.0 E-01	4.5 E+01 ^{b.3}	
Sulfate	1.6 E+01	2.5 E+02 ^{b.2}	
Zinc	1.2 E-02	5.0 E+00 ^{b.2}	
Trichloromethane ^d	1.1 E-02	1.0 E-01 ^{b.1}	
Beta activity (pCi/L) ^e	2.9 E+01		1.0 E+03
¹³⁷ Cs (pCi/L)	1.3 E+01	1.0 E+02 ^{b.3}	3.0 E+03
TDS	4.7 E+01	5.0 E+02 ^{b.2}	

NOTE: Measurements are in mg/L except where noted.

^aThe results are the mean values reported in Table 3-3.

^bScreening value 1 (SV1) lists the value first, basis second and an asterisk (*) third if the result exceeds the regulatory value; bases are listed below:

^{b.1}The proposed primary MCL

^{b.2}The proposed secondary MCL

^{b.3}The primary MCL

^{b.4}The secondary MCL.

The value is the smaller of two MCLs: the proposed primary MCL (or the primary MCL as a default) or the proposed secondary MCL (or the secondary MCL as a default). See WHC-EP-0342, *Hanford Site Stream-Specific Reports* (WHC 1990d).

^cScreening value 2 (SV2) lists the value first and a plus (+) second if the result exceeds the SV2). These values are derived concentration guides obtained from Appendix A of WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1990e).

^dThe SV1 value for trihalomethanes is used to evaluate trichloromethane results.

^eThe SV1 and SV2 values for gross alpha are used to evaluate alpha activity.

TDS = total dissolved solids

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Table 4-3. Deposition Rate for 163N
Demineralization Plant Wastewater.

Constituent	Concentration (kg/L) ^a	Deposition rate (kg/mo) ^a
Barium	2.25 E-08	1.12 E+00
Boron	2.85 E-08	1.41 E+00
Calcium	1.42 E-05	7.04 E+02
Chloride	1.25 E-06	6.20 E+01
Fluoride	1.70 E-07	8.43 E+00
Magnesium	3.44 E-06	1.71 E+02
Nitrate	5.00 E-07	2.48 E+01
Potassium	5.11 E-07	2.53 E+01
Silicon	1.86 E-06	9.23 E+01
Sodium	1.69 E-06	8.38 E+01
Strontium	6.60 E-08	3.27 E+00
Sulfate	1.58 E-05	7.84 E+02
Zinc	1.20 E-08	5.95 E-01
Ammonia	2.36 E-07	1.17 E+01
Hydrazine	5.90 E-08	2.93 E+00
Trichloromethane	1.10 E-08	5.46 E-01
Beta activity ^a	2.85 E-11	1.41 E-03
TDS	4.70 E-05	2.33 E+03
Total carbon	1.54 E-05	7.64 E+02
TOX (as Cl)	4.30 E-08	2.13 E+00
¹³⁷ Cs	1.29 E-11	6.40 E-04

NOTE: Values based on an average wastewater discharge of 8 gal/min, or 1.32×10^6 L/mo, as presented in Section 2.4, and sampling data collected between October 1989 and March 1990, for bypass configuration only.

^aConstituent concentrations are average values from Table 3-2. Concentration units of flagged (*) constituents are reported as curies per liter.

^bDeposition rate units of flagged (*) constituents are reported as curies per month.

TDS = total dissolved solids

TOX = total organic halides

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5.0 DESIGNATION

This section proposes that the 163N Demineralization Plant wastewater stream not be designated a dangerous waste as defined by Washington State Dangerous Waste Regulations (WAC 173-303). This proposed designation uses both process knowledge and present sample data (Sections 2.0 and 3.0).

WAC 173-303 contains the elements for determining if a waste is dangerous. These elements are illustrated in Figure 5-1 and include the following:

- Dangerous Waste Lists (WAC 173-303-080)
- Dangerous Waste Criteria (WAC 173-303-100)
- Dangerous Waste Characteristics (WAC 173-303-090).

A designation report for the 163N facility is shown in Table 5-1.

5.1 LISTED DANGEROUS WASTE

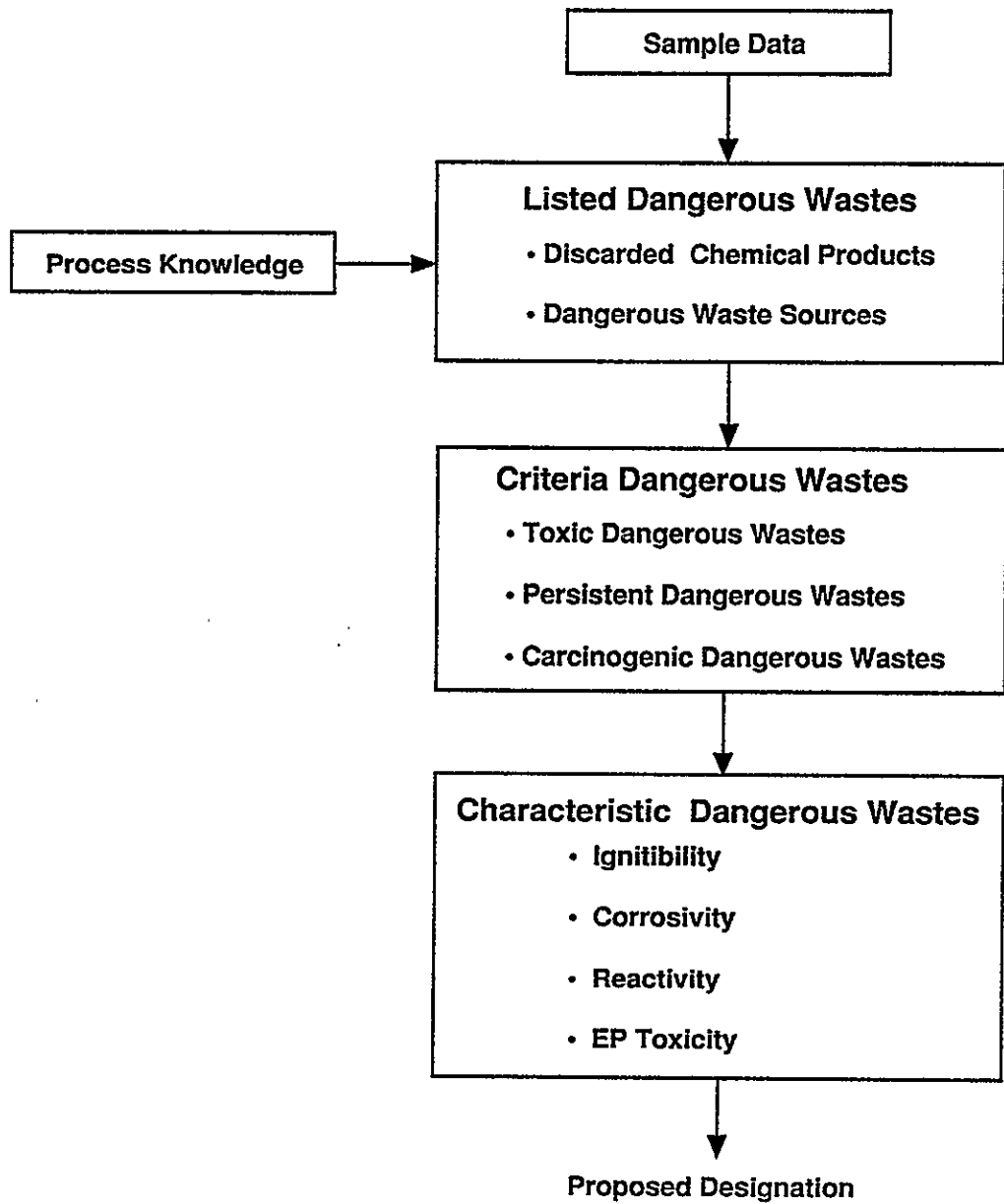
A waste is considered a listed dangerous waste if it either contains a discarded chemical product (WAC 173-303-081) or originates from a dangerous waste source (WAC 173-303-082). Designation of listed dangerous waste must be based upon a combination of process knowledge and sampling data.

5.1.1 Discarded Chemical Products

A wastestream constituent is a discarded chemical product (WAC 173-303-081) if it is listed in WAC 173-303-9903 and is characterized by one or more of the following descriptions.

- The listed constituent is the sole active ingredient in a commercial chemical product which has been discarded. (Commercial chemical products which, as purchased, contained two or more active ingredients, were not designated as discarded chemical products. Products which contained nonreactive components such as water, however, were designated if the sole active ingredient in the mixture was listed in WAC 173-303-9903.)
- The listed constituent results from a spill of unused chemicals. (A spill of a discarded chemical product into a stream would cause that stream to be designated during the time that the discharge is occurring. The approach taken is that the current wastestream would not be designated unless a review of past spill events indicates that the spills are predictable, systematic events that are ongoing or are reasonably anticipated to occur in the future.)

Figure 5-1. Designation Strategy.



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Dangerous Waste Data Designation Report for 163-N Demineralizer Plant Wastewater-Demineralizer Bypass

Finding: Undesignated

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number	Status	DW Number
Hydrogen fluoride	U134(DW)	Not Discarded	Undesignated
Hydrazine	U133(EHW)	Not Discarded	Undesignated
Trichloromethane	U044(EHW)	Not Discarded	Undesignated

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number	Status	DW Number
None	None	Not applicable	None

Infectious Dangerous Waste - WAC 173-303-083

No regulatory guidance

Dangerous Waste Mixtures - WAC 173-303-084

Substance	Toxic EC%	Persistent HH%	PAH%	Carcinogenic Total%
Barium chloride	4.58E-09	0.00E+00	0.00E+00	0.00E+00
Calcium tetraborate	7.01E-09	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	4.66E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium nitrate	1.26E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	1.41E-07	0.00E+00	0.00E+00	0.00E+00
Potassium fluoride	8.83E-08	0.00E+00	0.00E+00	0.00E+00
Sodium fluoride	1.82E-08	0.00E+00	0.00E+00	0.00E+00
Sodium metasilicate	4.96E-08	0.00E+00	0.00E+00	0.00E+00
Zinc nitrate	4.37E-09	0.00E+00	0.00E+00	0.00E+00
Ammonia	4.70E-07	0.00E+00	0.00E+00	0.00E+00
Hydrazine	1.48E-05	0.00E+00	0.00E+00	1.48E-05
Trichloromethane	1.10E-07	1.10E-06	0.00E+00	1.10E-06
Total	1.58E-05	1.10E-06	0.00E+00	1.59E-05
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Ignitability (Degrees F)	>199	Undesignated
Corrosivity-pH	6.04	Undesignated
Reactivity Cyanide (mg/kg)	<1.00E+02	Undesignated
Reactivity Sulfide (mg/kg)	<1.00E+02	Undesignated
EP Toxic Arsenic (mg/L)	<5.00E-01	Undesignated
EP Toxic Barium (mg/L)	<1.00E+00	Undesignated
EP Toxic Cadmium (mg/L)	<1.00E-01	Undesignated
EP Toxic Chromium (mg/L)	<5.00E-01	Undesignated
EP Toxic Lead (mg/L)	<5.00E-01	Undesignated
EP Toxic Mercury (mg/L)	<2.00E-02	Undesignated
EP Toxic Selenium (mg/L)	<5.00E-01	Undesignated
EP Toxic Silver (mg/L)	<5.00E-01	Undesignated

Dangerous Waste Criteria - WAC 173-303-100

Substance	Toxic EC%	Persistent HH%	PAH%	Carcinogenic Total%	DW Number-Positive
Barium chloride	4.58E-09	0.00E+00	0.00E+00	0.00E+00	
Calcium tetraborate	7.01E-09	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	4.66E-08	0.00E+00	0.00E+00	0.00E+00	

Table 5-1. Dangerous Waste Designation Report.
(sheet 1 of 2)

Dangerous Waste Data Designation Report for 163-N Demineralizer Plant Wastewater-Demineralizer Bypass

Dangerous Waste Criteria - WAC 173-303-100 - Continued

Substance	Toxic	Persistant		Carcinogenic	DW Number-Positive
	EC%	HH%	PAH%	Total%	
Magnesium nitrate	1.26E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	1.41E-07	0.00E+00	0.00E+00	0.00E+00	
Potassium fluoride	8.83E-08	0.00E+00	0.00E+00	0.00E+00	
Sodium fluoride	1.82E-08	0.00E+00	0.00E+00	0.00E+00	
Sodium metasilicate	4.96E-08	0.00E+00	0.00E+00	0.00E+00	
Zinc nitrate	4.37E-09	0.00E+00	0.00E+00	0.00E+00	
Ammonia	4.70E-07	0.00E+00	0.00E+00	0.00E+00	
Hydrazine	1.48E-05	0.00E+00	0.00E+00	1.48E-05	Undesignated
Trichloromethane	1.10E-07	1.10E-06	0.00E+00	1.10E-06	Undesignated
Total	1.58E-05	1.10E-06	0.00E+00	1.59E-05	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Hydrogen fluoride
Hydrazine
Trichloromethane
Barium and compounds, NOS

Substance names may include MB (monobasic), DB (dibasic), or TB (tribasic) to identify the equivalence of hydrogen ion that have been neutralized from polyprotic weak acids to form their conjugate bases.

Results based on a single datum are noted by an asterisk (*). Others are based on the lower limit of the one-tailed 90% confidence interval for pH data sets with mean values below 7.25 or by the upper limit of the one-tailed 90% confidence interval for all other data sets.

EP Toxic contaminants, ignitability, and reactivity are reported by standard methods when available. In the absence of EP Toxicity data, total contaminant concentrations are evaluated. In lieu of closed cup ignition results, ignitability is estimated from the sum of the contributions of all substances that are ignitable when pure. A waste is flagged as dangerous if sum of the ignitable substances exceeds one percent. Reactivity is by SW-846: 250 mg of cyanide as hydrogen cyanide per kg of waste or 500 mg of sulfide as hydrogen sulfide per kg of waste. Total cyanide and total sulfide are used in lieu of amenable cyanide and amenable sulfide.

Inorganic substances are formulated and their possible concentrations calculated for designation purposes only. The actual existence in the waste of these substances is not implied and should not be inferred.

Table 5-1. Dangerous Waste Designation Report.
(sheet 2 of 2)

The evaluation of this criterion is based on a review of spill reports made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA].)

- The listed constituent is discarded in the form of a residue resulting from cleanup of a spill of an unused chemical on the discarded chemical products list. (A chemical product that is used in a process and then released to the wastestream is not a discarded chemical product. Off-specification, unused chemicals, and chemicals that have exceeded a shelf life but have not been used are considered discarded chemical products.)

5.1.2 Dangerous Waste Sources

A list of dangerous waste sources is contained in WAC 173-303-9904, as referenced in WAC 173-303-082.

5.2 LISTED WASTE DATA CONSIDERATIONS

The proposed designation of the wastestream in this report is based on an evaluation of process and sampling data. The following sections describe the types of information used in this designation.

5.2.1 Process Evaluation

The process evaluation began with a review of contributors to the wastestream. The composition of the wastewater that was estimated based on process knowledge (Section 2.4) was compared with the discarded chemical products list and the dangerous waste source list. This process evaluation was necessary because the stream could be a listed waste if a listed waste was known to have been added systematically at any upstream location, even if a listed constituent was not detected at the sample point. The process evaluation included a review of chemical inventories for the 163N facility.

Additionally, interviews with operational personnel were conducted to determine if there are any procedures or laboratory processes that generated a listed waste that may not have been evident during other portions of the process evaluation.

If a listed chemical was identified, the specific use of the chemical was evaluated to determine if such use resulted in the systematic disposal of the listed waste to the effluent stream.

5.2.2 Present Sampling Data

Sampling data representing the period between October 1989 and March 1990 were used as verification to enhance and support the results of the process evaluation. This screening compared the results of the sampling

data to the WAC 173-303-9903 and -9904 lists. If a constituent was cited on one or both of these lists, an assessment was performed to determine if the constituent had entered the wastestream as a discarded chemical product or came from a dangerous waste source.

Screening organic constituents is a relatively simple procedure because analytical data for organic constituents are reported as compounds that may be directly compared to the WAC 173-303-9903 and -9904 lists. It is not as simple to screen inorganic analytical data because inorganic data are reported as ions or elements rather than as compounds. For example, an analysis may show that a wastestream contains the cations, sodium and calcium, along with the anions, chloride and nitrate. The possible neutral substances which can be formulated from this ion assemblage include sodium chloride, sodium nitrate, calcium chloride, and calcium nitrate. In a situation with many cation and anions, however, the list of possible combinations is extensive.

A procedure was developed by Westinghouse Hanford Company (Westinghouse Hanford) for combining the inorganic constituents into neutral compounds required for designation. Table 5-2 documents how this is done. The table accounts for charge balancing of the ion assemblage from Table 3-2, and for a subsequent formulation of neutral substances. This screening procedure is described in WHC-EP-0334 (WHC 1990d) and is intended only to be a screening tool in the evaluation of a wastestream. The listing of the inorganic compounds by this screening procedure is not intended to be an indication that the compound was discharged to the wastestream, only that the necessary cations and anions are present and an investigation should be conducted to determine how they entered the wastestream.

5.3 LISTED WASTE DESIGNATION

A process evaluation, along with a review of sampling data, indicated that the 163N Demineralization Plant wastewater stream did not contain a discarded chemical product or a listed waste source. The following sections discuss the evaluation that was conducted to substantiate this conclusion.

5.3.1 Discarded Chemical Products

As discussed in Section 5.2, a process evaluation of the contributors to the 163N Demineralization Plant wastewater stream was conducted. This evaluation included a review of plant chemical inventories compiled for compliance with the SARA Title III requirements for possible listed waste contributors. There are no chemical products stored at the 163N facility or used in the demineralization process that appear in the WAC 173-303-9903 list.

Table 5-1 contains a listing of the three potentially discarded chemical products identified from sampling data. One of these is a neutral inorganic compound postulated by using the screening procedure described in Section 5.2.2. The three potential discarded chemical products identified in the screening of the sampling data are hydrogen fluoride, hydrazine, and chloroform. None of these chemicals are used in the demineralization or

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Table 5-2. Inorganic Chemistry for 163N Demineralization Plant
Wastewater--Normal or "Bypass" Configuration.

Constituent	Value (ppb) ^a	Ion	Ion Concentration (Eq/g) ^b	Normalized (Eq/g)
Barium	3.02 E+01	Ba ⁺²	4.40 E-10	
Boron	7.62 E+01	B ₄ O ₇ ⁻²	3.52 E-09	7.18 E-09
Calcium	1.76 E+04	Ca ⁺²	8.78 E-07	
Chloride	1.71 E+03	Cl ⁻¹	4.83 E-08	9.83 E-08
Fluoride	1.82 E+02	F ⁻¹	9.60 E-09	1.95 E-08
Magnesium	4.23 E+03	Mg ⁺²	3.48 E-07	
Nitrate	5.00 E+02	NO ₃ ⁻¹	8.06 E-09	1.64 E-08
Potassium	5.94 E+02	K ⁺¹	1.52 E-08	
Silicon	2.17 E+03	SiO ₃ ⁻²	1.54 E-07	3.14 E-07
Sodium	1.97 E+03	Na ⁺¹	8.56 E-08	
Strontium	7.83 E+01	Sr ⁺²	1.79 E-09	
Sulfate	2.06 E+04	SO ₄ ⁻²	4.29 E-07	8.74 E-07
Zinc	1.51 E+01	Zn ⁺²	4.61 E-10	
Hydrogen ion (from pH 6.0)		H ⁺	(9.07 E-10)	
Hydroxide ion (from pH)		OH ⁻	(1.10 E-11)	
Cation total			1.33 E-06	
Anion total			6.53 E-07	
Anion normalization factor			2.036	

^aStatistics based on a single datum are noted by an asterisk (*). With the exception of hydrogen ion and hydroxide, others report the upper limit of the one-tailed 90% confidence interval. Hydrogen ion is based on the lower limit of the one-tailed 90% confidence interval for pH sets with mean values below 7.25 and on the upper limit of the one-tailed 90% confidence interval for pH data sets with mean values of 7.25 or higher. The hydroxide magnitude is equal to 1.00 E-20 (Eq/g)**2 divided by the hydrogen ion value (in "Ion concentration [Eq/g]").

^bIon concentrations in equivalents per gram (Eq/g) are based on the statistic. Conversions include scale (ppb to g/g), molecular weight (constituent form to ionic form), and equivalents (charges per ion). The column headed "Normalized" shows normalized concentrations (also in Eq/g) calculated by increasing concentrations of cations, excluding hydrogen ion, or anions, excluding hydroxide, by the normalization factor. The normalization factor is the larger of the cation total, including hydrogen ion, or anion total, including hydroxide, divided by the smaller total.

filtration process. Based on the considerations and data presented in the following sections, it is concluded that the 163N facility wastewater does not contain any discarded chemical products.

5.3.1.1 Hydrogen Fluoride (U134). Hydrogen fluoride, or hydrofluoric acid, is a postulated compound based on the presence of fluoride ion in the 163N facility wastewater, and the methodology of pairing ionic species to form neutral inorganic substances for screening purposes as described in Section 5.2.2. A review of plant chemical inventories and interviews with plant personnel did not show hydrogen fluoride to be present in any chemical product used in the 100N Area during the present sampling period.

Fluoride ion is found in the wastewater at a mean concentration of 170 ppb, with a maximum concentration of 174 ppb. The rejection criterion for fluoride based on sanitary water supplied to the 100N Area is 234 ppb, as presented in WHC-EP-0342 (WHC 1990e).

The source of fluoride in the water supply, in turn, is natural (i.e., Columbia River) and not a result of being discarded. Fluoride was not included in the raw water analysis used for this report (see Table 2-3), but fluoride appears at similar concentrations in raw water analyses conducted for other areas on the Hanford Site. In light of a probable source of fluoride in the raw water supply and the physical absence of hydrogen fluoride, the 163N facility wastewater is not considered a dangerous waste due to the presence of discarded hydrogen fluoride.

5.3.1.2 Hydrazine (U133). Hydrazine is used in the 184N Auxiliary Power Annex, which supplies steam to the 163N facility, as a water treatment chemical (i.e., oxygen scavenger) to protect carbon steel steam lines from corrosion. Hydrazine would be expected to appear as a result of this source, at low concentrations, in the steam condensate lines from the heater and degassifier. Although hydrazine readily reacts with oxygen to form nitrogen and water, small quantities (typically a few parts per billion) of unreacted hydrazine may, therefore, on occasion be discharged to the 1324NA Percolation Pond. For this facility, the quantities have been below the reportable quantity (RQ) of 1 lb/24-h period established by the CERCLA. Hydrazine did, however, appear above the contracted detection limit in one of the two samples taken, at a concentration of 88 ppb (or about 0.01 lb/24-h period, given this concentration and an average wastewater discharge of 8 gal/min).

Because hydrazine is used as a process additive in the steam supply to the 163N Demineralization Plant for corrosion control, and is not discarded intentionally, it is not considered a discarded chemical product.

5.3.1.3 Trichloromethane (Chloroform). Chloroform (U044) is commonly found in chlorinated water supplies at parts-per-billion levels as a byproduct of the chlorination process. Chloroform thus occurs in the 100N Area filtered water supply as a byproduct from chlorination at concentrations on the order of 20 ppb and was found in raw Columbia River water at 12 ppb. (Table 2-3).

A review of plant chemical inventories and interviews with plant personnel did not show chloroform to be present in any chemical product used or stored in the 100N Area.

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Chloroform appeared in both samples of the 163N facility wastewater, in both cases at 11 ppb. The rejection criterion for this chemical is 30 ppb as presented in Section 5.2 of WHC-EP-0342, based on its presence in the sanitary water supply to the 100N Area. As the sample concentrations are less than this rejection criterion, these data are not considered in the designation in light of the likely source of chloroform from the filtered and raw water supplies.

5.3.2 Dangerous Waste Sources

The process evaluation (see Section 5.2) was also used to determine if the wastestream included any specific or nonspecific waste sources listed in WAC 173-303-9904. As shown in Table 5-1, the filtered water bypass stream sampling data did not identify any listed waste sources. Based on this, it is concluded that the wastestream does not contain a dangerous waste source.

5.4 DANGEROUS WASTE CRITERIA

A waste is considered a dangerous waste if it meets any of the following criteria categories (WAC 303-100): toxic dangerous waste, persistent dangerous waste, or carcinogen dangerous waste. A description of the methods used to test the sampling data against the criteria is contained in WHC-EP-0334 (WHC 1990d). Summaries of the methods, along with the results, are contained in the following sections.

5.4.1 Toxic Dangerous Wastes

The procedure for determining if a wastestream is a toxic dangerous waste is as follows (WAC 173-303-101):

- Collect and analyze multiple samples from the wastestream
- Calculate the upper limit of the one-sided 90%CI for each analyte in the wastestream
- Formulate substances from the analytical data. (This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC-EP-0334 and is based on an evaluation of the most toxic compounds that can exist in an aqueous environment under normal temperatures and pressures.)
- Assign toxic categories to the substances detected or, in the case of inorganic analysis, postulated to be in the wastestream
- Calculate the contribution of each substance to the percent equivalent concentration (%EC).
- Calculate the %EC by summing the contributions of each substance

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- Designate the wastestream as a toxic dangerous waste if the %EC is greater than 0.001%, per WAC 173-303-9906.

Twelve chemical compounds potentially present in the 163N facility wastestream were determined to have toxic categories associated with them. These compounds are listed in Table 5-1, along with their individual and sum values. Since the sum is $1.58 \times 10^{-5}\%$ (1.58 E-05), which is less than the designation limit of 0.001%, the wastestream is not a toxic dangerous waste.

5.4.2 Persistent Dangerous Wastes

The procedure for determining if a wastestream is a persistent dangerous waste is as follows (WAC 173-303-102):

- Collect multiple grab samples of the wastestream
- Determine which chemical compounds in the wastestream are halogenated hydrocarbons (HH) and which are polycyclic aromatic hydrocarbons (PAH)
- Determine the upper limit of the one-sided 90 percent confidence interval (%CI) for the compounds of interest
- Calculate HH% and PAH% separately
- Sum the resulting for both HH% and PAH% contributors separately
- Designate the wastestream as persistent if the HH% is greater than 0.01% or if the PAH% is greater than 1.0%, per WAC 173-303-9907.

Chloroform, an HH, is the only persistent substance found in this discharge. The maximum concentration of chloroform is $1.10 \times 10^{-6}\%$ (1.10 E-06) which is four orders of magnitude below the 0.01% HH required for designation as a persistent wastestream. Therefore, it is concluded that this discharge is not a persistent dangerous waste.

5.4.3 Carcinogenic Dangerous Wastes

The procedure for determining if a wastestream is a carcinogenic dangerous waste is as follows (WAC 173-303-103):

- Collect multiple grab samples of the wastestream
- Determine the upper limit of the one-sided 90%CI for the compounds of interest

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- Formulate substances from the analytical data.
Note: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC-EP-0334 and is based on an evaluation of the most carcinogenic compounds that can exist in an aqueous environment under normal temperatures and pressures.
- Determine which chemical compounds in the wastestream are human or animal carcinogens according to the International Agency for Research on Cancer (IARC)
- Calculate the weight percent (wt%) concentration for each carcinogen
- Sum the resulting wt%
- Designate the wastestream as carcinogenic if any of the positive (human or animal) carcinogens are above 0.01% or if the total concentration for positive and suspected (human or animal) carcinogen is above 1.0%.

Two chemical compounds potentially present in the 163N Demineralization Plant effluent were determined to be carcinogenic. These compounds are chloroform (trichloromethane) and hydrazine. The values for these chemicals are listed in Table 5-1. Since none of the positive carcinogens exceed 0.01% and the sum is $1.59 \times 10^{-5}\%$ (1.59 E-05), which is less than the designation limit of 1.0%, the 163N Demineralization Plant effluent is not a carcinogenic dangerous waste.

5.5 DANGEROUS WASTE CHARACTERISTICS

A waste is considered a dangerous waste if it is ignitable, corrosive, reactive, or extraction procedure toxic (WAC 173-303-090). A description of the methods used to evaluate the data in terms of these characteristics is contained in WHC-EP-0334. Summaries of the methods, along with the results, are contained in the following sections.

5.5.1 Ignitability

Ignitability or flashpoint testing showed the samples have a flashpoint greater than 199 °F. Thus, the samples were found to be not ignitable.

5.5.2 Corrosivity

A waste is a corrosive dangerous waste if it has a pH of less than or equal to 2.0 or greater than or equal to 12.5. The pH values observed during sampling were between 6.25 and 6.45, within a 90%CI from 6.04 to 6.66. Therefore, the 163N facility wastewater is not a corrosive dangerous waste (WAC 173-303-090[6]).

5.5.3 Reactivity

An aqueous waste is reactive if it an amount of cyanide or sulfide under conditions near corrosivity to threaten human health or the environment (WAC 173-303-090[7]). A recent revision to the SW-846 procedure provides a more quantitative "indicator" level for cyanide and sulfide. These indicator levels for hydrogen cyanide and hydrogen sulfide are 250 mg/kg and 500 mg/kg, respectively. If the upper 90%CI for the compounds in the effluent streams were below these levels, the streams were considered not regulated based on reactivity.

Reactive cyanide was less than 100 mg/kg. Reactive sulfide was less than 100 mg/kg. Therefore, the 163N facility wastewater is not a reactive dangerous waste.

5.5.4 Extraction Procedure Toxicity

A waste is an extraction procedure toxic dangerous waste if contaminant results from Extraction Procedure toxicity testing exceed the limits of WAC 173-303-090(8)(c). In the absence of specific Extraction Procedure toxicity test results, total analyte concentrations are used. No analytes with concentrations within or in excess of the ranges given in the Extraction Procedure Toxicity List of WAC 173-303-090 were found in the 163N Demineralization Plant effluent. The concentrations of eight Extraction Procedure toxic metals detected are listed in Table 5-1. Therefore, the 163N facility wastewater is not an Extraction Procedure toxic dangerous waste.

5.6 DESIGNATION

It is proposed that the 163N facility wastewater not be designated a dangerous waste, as defined in WAC 173-303-070, based on the above evaluation.

6.0 ACTION PLAN

This chapter addresses recommendations for future waste characterization tasks for the liquid effluents that are within the scope of the Liquid Effluent Study. The final extent of and schedule for any recommended tasks are subject to negotiation between Ecology, the EPA, and the DOE. An implementation schedule for the compliance actions is already under way as part of the Tri-Party Agreement (Ecology et al. 1989) and contingent on the availability of funding. All effluent monitoring and sampling will be conducted according to DOE Order 5400.1 (*General Environmental Protection Program*, issued November 9, 1988).

6.1 FUTURE SAMPLING

The 163N facility has two basic process configurations, regeneration and normal or "bypass."

During the random sampling conducted between October 1989 and March 1990, the 163N facility operated in both process configurations, but only the bypass configuration was sampled. This occurred because of the random sampling times only found the plant in the bypass configuration.

Analytical results from regeneration configuration sampling conducted before October 1989 are contained in Appendix B. According to current plans, after the final resin removal, the 163N Demineralization Plant will not be operated; future sampling of the wastewater for the purpose of this report is not warranted.

Sampling has been conducted to support an NPDES permit application revision to route the 163N facility wastewater directly to the Columbia River through outfall 009 in the event of a restart. Results from this sampling are available for both plant configurations but are not contained in this addendum. Any future sampling will be conducted to support the NPDES permitting process.

6.2 TECHNICAL ISSUES

As described in Section 2.0, the effluent was sampled at the outfall to the 1324NA facility. This sample point was chosen because it is an accessible location downstream of all contributing wastestreams.

The samples collected at this point are considered to be representative of the constituents present in the contributing wastestreams, and the characterization data presented in this addendum is considered to be representative of the bypass configuration of the 163N facility.

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APPENDIX A

PRESENT SAMPLING DATA FOR DESIGNATION OF THE
163N DEMINERALIZATION PLANT WASTEWATER:
OCTOBER 1989 THROUGH MARCH 1990

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Table A-1. Sampling Data for 163N Demineralization
Plant Wastewater--Bypass. (sheet 1 of 4)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Arsenic (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Arsenic (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Barium	50869	01/03/90	ICP	2.50 E+01
Barium	50923	02/09/90	ICP	2.00 E+01
Barium (EP Toxic)	50869E	01/03/90	ICP	<1.00 E+03
Barium (EP Toxic)	50923E	02/09/90	ICP	<1.00 E+03
Boron	50869	01/03/90	ICP	1.30 E+01
Boron	50923	02/09/90	ICP	4.40 E+01
Cadmium (EP Toxic)	50869E	01/03/90	ICP	<1.00 E+02
Cadmium (EP Toxic)	50923E	02/09/90	ICP	<1.00 E+02
Calcium	50869	01/03/90	ICP	1.53 E+04
Calcium	50923	02/09/90	ICP	1.31 E+04
Chloride	50869	01/03/90	IC	1.40 E+03
Chloride	50923	02/09/90	IC	1.10 E+03
Chromium (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Chromium (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Fluoride	50869	01/03/90	IC	<5.00 E+02
Fluoride	50869	01/03/90	ISE	1.74 E+02
Fluoride	50923	02/09/90	IC	<5.00 E+02
Fluoride	50923	02/09/90	ISE	1.66 E+02
Lead (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Lead (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Magnesium	50869	01/03/90	ICP	3.70 E+03
Magnesium	50923	02/09/90	ICP	3.19 E+03
Mercury (EP Toxic)	50869E	01/03/90	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50923E	02/09/90	CVAA/M	<2.00 E+01
Nitrate	50869	01/03/90	IC	5.00 E+02
Nitrate	50923	02/09/90	IC	<5.00 E+02
Potassium	50869	01/03/90	ICP	5.38 E+02
Potassium	50923	02/09/90	ICP	4.84 E+02
Selenium (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Selenium (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Silicon	50869	01/03/90	ICP	1.96 E+03
Silicon	50923	02/09/90	ICP	1.76 E+03
Silver (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Silver (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Sodium	50869	01/03/90	ICP	1.78 E+03
Sodium	50923	02/09/90	ICP	1.60 E+03
Strontium	50869	01/03/90	ICP	7.00 E+01
Strontium	50923	02/09/90	ICP	6.20 E+01
Sulfate	50869	01/03/90	IC	1.74 E+04
Sulfate	50923	02/09/90	IC	1.43 E+04
Zinc	50869	01/03/90	ICP	1.30 E+01
Zinc	50923	02/09/90	ICP	1.10 E+01
Ammonia	50869	01/03/90	ISE	1.60 E+02

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Table A-1. Sampling Data for 163N Demineralization
Plant Wastewater--Bypass. (sheet 2 of 4)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Ammonia	50923	02/09/90	ISE	3.12 E+02
2-butanone	50869	01/03/90	VOA	<1.00 E+01
2-butanone	50869B	01/03/90	VOA	1.40 E+01
2-butanone	50869T	01/03/90	VOA	1.50 E+01
2-butanone	50923	02/09/90	VOA	<1.00 E+01
2-butanone	50923B	02/09/90	VOA	<6.00 E+00
2-butanone	50923T	02/09/90	VOA	<6.00 E+00
Dichloromethane	50869	01/03/90	VOA	<5.00 E+00
Dichloromethane	50869B	01/03/90	VOA	<5.00 E+00
Dichloromethane	50869T	01/03/90	VOA	1.30 E+01
Dichloromethane	500923	02/09/90	VOA	<5.00 E+00
Dichloromethane	50923B	02/09/90	VOA	<5.00 E+00
Dichloromethane	50923T	02/09/90	VOA	<5.00 E+00
Hydrazine	50869	01/03/90	SPEC	<3.00 E+01
Hydrazine	50923	02/09/90	SPEC	8.80 E+01
Trichloromethane	50869	01/03/90	VOA	1.10 E+01
Trichloromethane	50869B	01/03/90	VOA	<3.00 E+00
Trichloromethane	50869T	01/03/90	VOA	<5.00 E+00
Trichloromethane	50923	02/09/90	VOA	1.10 E+01
Trichloromethane	50923B	02/09/90	VOA	<5.00 E+00
Trichloromethane	50923T	02/09/90	VOA	<5.00 E+00
Alkalinity (method B)	50869	01/03/90	TITRA	4.10 E+04
Alkalinity (method B)	50923	02/09/90	TITRA	3.70 E+04
Beta activity (pCi/L)	50869	01/03/90	Beta	2.85 E+01
Conductivity (μS)	50869	01/03/90	COND-F1d	1.43 E+02
Conductivity (μS)	50923	02/09/90	COND-F1d	1.22 E+02
Ignitability (°F) ^b	50869E	01/03/90	IGNIT	2.12 E+02
Ignitability (°F) ^b	50923E	02/09/90	IGNIT	2.06 E+02
pH (dimensionless)	50869	01/03/90	PH-F1d	6.45 E+00
pH (dimensionless)	50923	02/09/90	PH-F1d	6.25 E+00
Reactivity cyanide (mg/kg)	50869E	01/03/90	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50923E	02/09/90	DSPEC	<1.00 E+02
Reactivity sulfide (mg/kg)	50869E	01/03/90	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50923E	02/09/90	DTITRA	<1.00 E+02
TDS	50869	01/03/90	TDS	3.60 E+04
TDS	50923	02/09/90	TDS	5.80 E+04
Temperature (°C)	50869	01/03/90	TEMP-F1d	2.23 E+01
Temperature (°C)	50923	02/09/90	TEMP-F1d	2.31 E+01
Total carbon	50869	01/03/90	TC	1.68 E+04
Total carbon	50923	02/09/90	TC	1.40 E+04
TOX (as Cl)	50869	01/03/90	LTOX	4.80 E+01
TOX (as Cl)	50923	02/09/90	LTOX	3.80 E+01
¹³⁷ Cs (pCi/L)	50869	01/03/90	GEA	1.29 E+01

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Table A-1. Sampling Data for 163N Demineralization
Plant Wastewater--Bypass. (sheet 3 of 4)

NOTE: Measurements are in ppb unless noted.

AA = atomic absorption spectroscopy

EP = Extraction Procedure Toxicity Test

GC = gas chromatography

ICP = inductively-coupled plasma spectroscopy

MS = mass spectrometry

TDS = total dissolved solids

TOX = total organic halides

^aSee Table 3-1 for corresponding chain-of-custody number and explanations of sample number suffix.

^bIgnitability is the maximum temperature of the test (no sample actually ignited).

^cMethods code:

Code	Analytical Method	Reference ^d
ABN	Semivolatile organics (GC/MS)	USEPA-8270
AEA	²⁴¹ Am	UST-20Am01
AEA	Curium isotopes	UST-20Am/Cm01
AEA	Plutonium isotopes	UST-20Pu01
AEA	Uranium isotopes	UST-20U01
ALPHA	Alpha counting	EPA-680/4-75/1
ALPHA-Ra	Total radium alpha counting	ASTM-D2460
BETA	Beta counting	EPA-680/4-75/1
BETA	⁹⁰ Sr	UST-20Sr02
COLIF	Coliform bacteria	USEPA-9131
COLIFM	Coliform bacteria (membrane filter)	USEPA-9132
COND-Fld	Conductivity-field	ASTM-D1125A
COND-Lab	Conductivity-laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-mixed matrix	USEPA-7470
DIGC	Direct aqueous injection (GC)	UST-70DIGC
DIMS	Direct aqueous injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive cyanide (distillation, spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive sulfide (distillation, titration)	USEPA-CHAPTER 7
FLUOR	uranium (fluorometry)	ASTM-D2907-83
GEA	Gamma energy analysis spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, furnace technique)	USEPA-7060
GFAA	Lead (AA, furnace technique)	USEPA-7421
GFAA	Selenium (AA, furnace technique)	USEPA-7740
GFAA	Thallium (AA, furnace technique)	USEPA-7841
IC	Ion chromatography	EPA-600/4-84-01
ICP	Atomic emission spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic emission spectroscopy (ICP)-mixed matrix	USEPA-6010
IGNIT	Pensky-martens closed-cup ignitability	USEPA-1010

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Table A-1. Sampling Data for 163N Demineralization
Plant Wastewater--Bypass. (sheet 4 of 4)

Code	Analytical Method	Reference ^d
ISE	Fluoride-low detection limit	ASTM-D1179-80-B
ISE	Ammonium ion	ASTM-D1426-D
LALPHA	Alpha activity-low detection limit	EPA-680/4-75/1
LEPD	¹²⁹ I	UST-20I02
LSC	¹⁴ C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total organic halides-low detection limit	USEPA-9020
PH-Fld	pH-field	USEPA-9040
PH-Lab	pH-laboratory	USEPA-9040
SPEC	Total and amenable cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-low detection limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended solids	SM-208D
TC	Total carbon	USEPA-9060
TDS	Total dissolved solids	SM-208B
TEMP-Fld	Temperature-field	Local
TITRA	Alkalinity-method B (titration)	ASTM-D1067B
TITRA	Sulfides (titration)	USEPA-9030
TOC	Total organic carbon	USEPA-9060
TOX	Total organic halides	USEPA-9020
VOA	Volatile organics (GC/MS)	USEPA-8240

^dReference:

- | | |
|-------|---|
| ASTM | - <i>1986 Annual Book of ASTM Standards</i> , American Society for Testing and Materials, Philadelphia, Pennsylvania. |
| EPA | - Various methods of the U.S. Environmental Protection Agency, Washington, D.C. |
| UST | - Methods of the contract laboratory. |
| SM | - <i>Standard Methods for the Examination of Water and Wastewater</i> , 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C. |
| USEPA | - <i>Test Methods for Evaluating Solid Waste Physical/Chemical Methods</i> , 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C. |

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APPENDIX B

SAMPLING DATA FOR THE 163N DEMINERALIZATION
PLANT: JANUARY 1988 THROUGH MARCH 1990

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163N Demineralization Plant Wastewater

Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 1 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Aluminum	50378	01/21/88	ICP	1.77 E+02
Aluminum	50404	03/22/88	ICP	<1.50 E+02
Aluminum	50430	06/16/88	ICP	<1.50 E+02
Aluminum	50464	09/27/88	ICP	3.99 E+02
Barium	50378	01/21/88	ICP	6.20 E+01
Barium	50404	03/22/88	ICP	3.60 E+01
Barium	50430	06/16/88	ICP	5.50 E+01
Barium	50464	09/27/88	ICP	9.70 E+01
Calcium	50378	01/21/88	ICP	4.98 E+04
Calcium	50404	03/22/88	ICP	1.83 E+04
Calcium	50430	06/16/88	ICP	3.29 E+04
Calcium	50464	09/27/88	ICP	2.39 E+05
Chloride	50378	01/21/88	IC	2.19 E+04
Chloride	50404	03/22/88	IC	1.94 E+03
Chloride	50430	06/16/88	IC	4.00 E+03
Chloride	50464	09/27/88	IC	1.36 E+04
Copper	50378	01/21/88	ICP	1.00 E+01
Copper	50404	03/22/88	ICP	<1.00 E+01
Copper	50430	06/16/88	ICP	<1.00 E+01
Copper	50464	09/27/88	ICP	2.40 E+01
Fluoride	50378	01/21/88	IC	4.67 E+03
Fluoride	50378	01/21/88	ISE	2.55 E+03
Fluoride	50404	03/22/88	IC	<5.00 E+02
Fluoride	50404	03/22/88	ISE	1.79 E+02
Fluoride	50430	06/16/88	IC	<5.00 E+02
Fluoride	50430	06/16/88	ISE	3.46 E+02
Fluoride	50464	09/27/88	IC	1.98 E+03
Fluoride	50464	09/27/88	ISE	1.08 E+03
Iron	50378	01/21/88	ICP	2.75 E+02
Iron	50404	03/22/88	ICP	3.90 E+01
Iron	50430	06/16/88	ICP	5.70 E+01
Iron	50464	09/27/88	ICP	2.92 E+02
Magnesium	50378	01/21/88	ICP	1.22 E+04
Magnesium	50404	03/22/88	ICP	3.95 E+03
Magnesium	50430	06/16/88	ICP	7.49 E+03
Magnesium	50464	09/27/88	ICP	5.35 E+04
Manganese	50378	01/21/88	ICP	1.40 E+01
Manganese	50404	03/22/88	ICP	<5.00 E+00
Manganese	50430	06/16/88	ICP	1.40 E+01
Manganese	50464	09/27/88	ICP	3.60 E+01
Mercury	50378	01/21/88	CVAA	<1.00 E-01
Mercury	50404	03/22/88	CVAA	<1.00 E-01
Mercury	50430	06/16/88	CVAA	<1.00 E-01
Mercury	50464	09/27/88	CVAA	1.00 E-01
Nitrate	50378	01/21/88	IC	5.22 E+03

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 2 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Nitrate	50404	03/22/88	IC	6.49 E+02
Nitrate	50430	06/16/88	IC	<5.00 E+02
Nitrate	50464	09/27/88	IC	1.06 E+03
Potassium	50378	01/21/88	ICP	2.43 E+03
Potassium	50404	03/22/88	ICP	6.01 E+02
Potassium	50430	06/16/88	ICP	1.22 E+03
Potassium	50464	09/27/88	ICP	7.11 E+03
Sodium	50378	01/21/88	ICP	1.24 E+06
Sodium	50404	03/22/88	ICP	7.43 E+04
Sodium	50430	06/16/88	ICP	6.49 E+04
Sodium	50464	09/27/88	ICP	6.36 E+05
Strontium	50378	01/21/88	ICP	2.37 E+02
Strontium	50404	03/22/88	ICP	8.50 E+01
Strontium	50430	06/16/88	ICP	1.35 E+02
Strontium	50464	09/27/88	ICP	1.01 E+03
Sulfate	50378	01/21/88	IC	2.42 E+06
Sulfate	50404	03/22/88	IC	1.65 E+05
Sulfate	50430	06/16/88	IC	1.52 E+05
Sulfate	50464	09/27/88	IC	2.02 E+06
Uranium	50378	01/21/88	FLUOR	3.08 E-01
Uranium	50404	03/22/88	FLUOR	6.35 E-01
Uranium	50430	06/16/88	FLUOR	2.70 E-01
Uranium	50464	09/27/88	FLUOR	2.94 E+00
Vanadium	50378	01/21/88	ICP	<5.00 E+00
Vanadium	50404	03/22/88	ICP	<5.00 E+00
Vanadium	50430	06/16/88	ICP	<5.00 E+00
Vanadium	50464	09/27/88	ICP	7.00 E+00
Zinc	50378	01/21/88	ICP	4.40 E+01
Zinc	50404	03/22/88	ICP	1.30 E+01
Zinc	50430	06/16/88	ICP	4.20 E+01
Zinc	50464	09/27/88	ICP	1.31 E+02
Ammonia	50378	01/21/88	ISE	<5.00 E+01
Ammonia	50404	03/22/88	ISE	<5.00 E+01
Ammonia	50430	06/16/88	ISE	8.40 E+01
Ammonia	50464	09/27/88	ISE	8.40 E+01
Morpholine	50430	06/16/88	ABN	2.00 E+01
1,1,1-trichloroethane	50378	01/21/88	VOA	<5.00 E+00
1,1,1-trichloroethane	50378B	01/21/88	VOA	5.00 E+00
1,1,1-trichloroethane	50404	03/22/88	VOA	<5.00 E+00
1,1,1-trichloroethane	50404B	03/22/88	VOA	<5.00 E+00
1,1,1-trichloroethane	50430	06/16/88	VOA	<5.00 E+00
1,1,1-trichloroethane	50430B	06/16/88	VOA	<5.00 E+00
1,1,1-trichloroethane	50464	09/27/88	VOA	<5.00 E+00
1,1,1-trichloroethane	50464B	09/27/88	VOA	<5.00 E+00
Trichloromethane	50378	01/21/88	VOA	<5.00 E+00

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 3 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Trichloromethane	50378B	01/21/88	VOA	1.50 E+01
Trichloromethane	50404	03/22/88	VOA	<3.00 E+00
Trichloromethane	50404B	03/22/88	VOA	1.00 E+01
Trichloromethane	50430	06/16/88	VOA	1.20 E+01
Trichloromethane	50430B	06/16/88	VOA	<5.00 E+00
Trichloromethane	50464	09/27/88	VOA	<5.00 E+00
Trichloromethane	50464B	09/27/88	VOA	<5.00 E+00
Alpha activity (pCi/L)	50378	01/21/88	Alpha	3.05 E-01
Alpha activity (pCi/L)	50404	03/22/88	Alpha	8.67 E-01
Alpha activity (pCi/L)	50430	06/16/88	Alpha	<5.12 E-03
Beta activity (pCi/L)	50378	01/21/88	Beta	1.34 E+01
Beta activity (pCi/L)	50404	03/22/88	Beta	2.07 E+00
Beta activity (pCi/L)	50430	06/16/88	Beta	5.96 E+00
Beta activity (pCi/L)	50464	09/27/88	Beta	2.38 E+01
Conductivity (μS)	50378	01/21/88	COND-Fld	5.42 E+03
Conductivity (μS)	50404	03/22/88	COND-Fld	5.25 E+02
Conductivity (μS)	50430	06/16/88	COND-Fld	3.97 E+02
Conductivity (μS)	50464	09/27/88	COND-Fld	3.25 E+03
pH (dimensionless)	50378	01/21/88	PH-Fld	6.98 E+00
pH (dimensionless)	50404	03/22/88	PH-Fld	6.61 E+00
pH (dimensionless)	50430	06/16/88	PH-Fld	7.45 E+00
pH (dimensionless)	50464	09/27/88	PH-Fld	4.25 E+00
Temperature (°C)	50378	01/21/88	TEMP-Fld	2.24 E+01
Temperature (°C)	50404	03/22/88	TEMP-Fld	1.97 E+01
Temperature (°C)	50430	06/16/88	TEMP-Fld	2.64 E+01
Temperature (°C)	50464	09/27/88	TEMP-Fld	1.85 E+01
TOC	50378	01/21/88	TOC	5.83 E+03
TOC	50404	03/22/88	TOC	<9.14 E+02
TOC	50430	06/16/88	TOC	2.12 E+03
TOC	50464	09/27/88	TOC	3.20 E+03
TOX (as Cl)	50378	01/21/88	LTOX	8.97 E+01
TOX (as Cl)	50404	03/22/88	LTOX	3.20 E+01
TOX (as Cl)	50430	06/16/88	LTOX	8.65 E+01
TOX (as Cl)	50464	09/27/88	LTOX	1.04 E+02
Arsenic (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Arsenic (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Barium	50388	03/07/88	ICP	2.90 E+01
Barium	50406	03/25/88	ICP	2.10 E+01
Barium	50418	05/11/88	ICP	3.40 E+01
Barium	50458	09/21/88	ICP	<6.00 E+00
Barium	50869	01/03/90	ICP	2.50 E+01
Barium	50923	02/09/90	ICP	2.00 E+01
Barium (EP Toxic)	50869E	01/03/90	ICP	<1.00 E+03
Barium (EP Toxic)	50923E	02/09/90	ICP	<1.00 E+03
Boron	50869	01/03/90	ICP	1.30 E+01

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163N Demineralization Plant Wastewater

Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 4 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Boron	50923	02/09/90	ICP	4.40 E+01
Cadmium (EP Toxic)	50869E	01/03/90	ICP	<1.00 E+02
Cadmium (EP Toxic)	50923E	02/09/90	ICP	<1.00 E+02
Calcium	50388	03/07/88	ICP	2.08 E+04
Calcium	50406	03/25/88	ICP	1.73 E+04
Calcium	50418	05/11/88	ICP	1.77 E+04
Calcium	50458	09/21/88	ICP	1.01 E+03
Calcium	50869	01/03/90	ICP	1.53 E+04
Calcium	50923	02/09/90	ICP	1.31 E+04
Chloride	50388	03/07/88	IC	1.25 E+03
Chloride	50406	03/25/88	IC	1.23 E+03
Chloride	50418	05/11/88	IC	2.19 E+03
Chloride	50458	09/21/88	IC	<5.00 E+02
Chloride	50869	01/03/90	IC	1.40 E+03
Chloride	50923	02/09/90	IC	1.10 E+03
Chromium (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Chromium (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Fluoride	50388	03/07/88	IC	<5.00 E+02
Fluoride	50388	03/07/88	ISE	1.03 E+02
Fluoride	50406	03/25/88	IC	<5.00 E+02
Fluoride	50406	03/25/88	ISE	1.64 E+02
Fluoride	50418	05/11/88	IC	<5.00 E+02
Fluoride	50418	05/11/88	ISE	1.55 E+02
Fluoride	50458	09/21/88	IC	<5.00 E+02
Fluoride	50458	09/21/88	ISE	4.30 E+01
Fluoride	50869	01/03/90	IC	<5.00 E+02
Fluoride	50869	01/03/90	ISE	1.74 E+02
Fluoride	50923	02/09/90	IC	<5.00 E+02
Fluoride	50923	02/09/90	ISE	1.66 E+02
Iron	50388	03/07/88	ICP	<3.00 E+01
Iron	50406	03/25/88	ICP	<3.00 E+01
Iron	50418	05/11/88	ICP	<3.00 E+01
Iron	50458	09/21/88	ICP	4.00 E+01
Iron	50869	01/03/90	ICP	<3.00 E+01
Iron	50923	02/09/90	ICP	<3.00 E+01
Lead (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Lead (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Magnesium	50388	03/07/88	ICP	4.96 E+03
Magnesium	50406	03/25/88	ICP	4.12 E+03
Magnesium	50418	05/11/88	ICP	4.41 E+03
Magnesium	50458	09/21/88	ICP	2.26 E+02
Magnesium	50869	01/03/90	ICP	3.70 E+03
Magnesium	50923	02/09/90	ICP	3.19 E+03
Manganese	50388	03/07/88	ICP	<5.00 E+00
Manganese	50406	03/25/88	ICP	<5.00 E+00

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 5 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Manganese	50418	05/11/88	ICP	5.00 E+00
Manganese	50458	09/21/88	ICP	<5.00 E+00
Manganese	50869	01/03/90	ICP	<5.00 E+00
Manganese	50923	02/09/90	ICP	<5.00 E+00
Mercury (EP Toxic)	50869E	01/03/90	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50923E	02/09/90	CVAA/M	<2.00 E+01
Nitrate	50388	03/07/88	IC	<5.00 E+02
Nitrate	50406	03/25/88	IC	<5.00 E+02
Nitrate	50418	05/11/88	IC	<5.00 E+02
Nitrate	50458	09/21/88	IC	<5.00 E+02
Nitrate	50869	01/03/90	IC	5.00 E+02
Nitrate	50923	02/09/90	IC	<5.00 E+02
Potassium	50388	03/07/88	ICP	7.34 E+02
Potassium	50406	03/25/88	ICP	5.53 E+02
Potassium	50418	05/11/88	ICP	6.86 E+02
Potassium	50458	09/21/88	ICP	<1.00 E+02
Potassium	50869	01/03/90	ICP	5.38 E+02
Potassium	50923	02/09/90	ICP	4.84 E+02
Selenium (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Selenium (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Silicon	50869	01/03/90	ICP	1.96 E+03
Silicon	50923	02/09/90	ICP	1.76 E+03
Silver (EP Toxic)	50869E	01/03/90	ICP	<5.00 E+02
Silver (EP Toxic)	50923E	02/09/90	ICP	<5.00 E+02
Sodium	50388	03/07/88	ICP	2.12 E+03
Sodium	50406	03/25/88	ICP	1.61 E+03
Sodium	50418	05/11/88	ICP	2.26 E+03
Sodium	50458	09/21/88	ICP	2.30 E+03
Sodium	50869	01/03/90	ICP	1.78 E+03
Sodium	50923	02/09/90	ICP	1.60 E+03
Strontium	50388	03/07/88	ICP	1.02 E+02
Strontium	50406	03/25/88	ICP	8.80 E+01
Strontium	50418	05/11/88	ICP	7.90 E+01
Strontium	50458	09/21/88	ICP	<2.00 E+01
Strontium	50869	01/03/90	ICP	7.00 E+01
Strontium	50923	02/09/90	ICP	6.20 E+01
Sulfate	50388	03/07/88	IC	1.94 E+04
Sulfate	50406	03/25/88	IC	1.72 E+04
Sulfate	50418	05/11/88	IC	2.32 E+04
Sulfate	50458	09/21/88	IC	6.21 E+03
Sulfate	50869	01/03/90	IC	1.74 E+04
Sulfate	50923	02/09/90	IC	1.43 E+04
Uranium	50388	03/07/88	FLUOR	3.98 E-01
Uranium	50406	03/25/88	FLUOR	1.93 E-01
Uranium	50418	05/11/88	FLUOR	4.82 E+00

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 6 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Uranium	50458	09/21/88	FLUOR	<1.15 E-01
Uranium	50869	01/03/90	FLUOR	<6.29 E-02
Zinc	50388	03/07/88	ICP	1.00 E+01
Zinc	50406	03/25/88	ICP	9.00 E+00
Zinc	50418	05/11/88	ICP	1.10 E+01
Zinc	50458	09/21/88	ICP	6.00 E+00
Zinc	50869	01/03/90	ICP	1.30 E+01
Zinc	50923	02/09/90	ICP	1.10 E+01
Acetone	50458	09/21/88	VOA	5.00 E+01
Acetone	50869	01/03/90	VOA	<1.00 E+01
Acetone	50869	01/03/90	ABN	<1.00 E+01
Acetone	50869B	01/03/90	VOA	<1.00 E+01
Acetone	50869T	01/03/90	VOA	<1.00 E+01
Acetone	50923	02/09/90	VOA	<5.00 E+00
Acetone	50923	02/09/90	ABN	<1.00 E+01
Acetone	50923B	02/09/90	VOA	<1.00 E+01
Acetone	50923T	02/09/90	VOA	<1.00 E+01
Ammonia	50388	03/07/88	ISE	<5.00 E+01
Ammonia	50406	03/25/88	ISE	<5.00 E+01
Ammonia	50418	05/11/88	ISE	5.80 E+01
Ammonia	50458	09/21/88	ISE	<5.00 E+01
Ammonia	50869	01/03/90	ISE	1.60 E+02
Ammonia	50923	02/09/90	ISE	3.12 E+02
2-butanone	50388	03/07/88	VOA	<1.00 E+01
2-butanone	50388B	03/07/88	VOA	<1.00 E+01
2-butanone	50406	03/25/88	VOA	<1.00 E+01
2-butanone	50406B	03/25/88	VOA	<1.00 E+01
2-butanone	50418	05/11/88	VOA	<1.00 E+01
2-butanone	50418B	05/11/88	VOA	<1.00 E+01
2-butanone	50458	09/21/88	VOA	<1.00 E+01
2-butanone	50458B	09/21/88	VOA	<1.00 E+01
2-butanone	50869	01/03/90	VOA	<1.00 E+01
2-butanone	50869B	01/03/90	VOA	1.40 E+01
2-butanone	50869T	01/03/90	VOA	1.50 E+01
2-butanone	50923	02/09/90	VOA	<1.00 E+01
2-butanone	50923B	02/09/90	VOA	<6.00 E+00
2-butanone	50923T	02/09/90	VOA	<6.00 E+00
Dichloromethane	50388	03/07/88	VOA	<1.00 E+01
Dichloromethane	50388B	03/07/88	VOA	<1.00 E+01
Dichloromethane	50406	03/25/88	VOA	<1.00 E+01
Dichloromethane	50406B	03/25/88	VOA	<1.00 E+01
Dichloromethane	50418	05/11/88	VOA	<1.00 E+01
Dichloromethane	50418B	05/11/88	VOA	<1.00 E+01
Dichloromethane	50458	09/21/88	VOA	<1.00 E+01
Dichloromethane	50458B	09/21/88	VOA	<1.00 E+01

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 7 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
Dichloromethane	50869	01/03/90	VOA	<5.00 E+00
Dichloromethane	50869B	01/03/90	VOA	<5.00 E+00
Dichloromethane	50869T	01/03/90	VOA	1.30 E+01
Dichloromethane	50923	02/09/90	VOA	<5.00 E+00
Dichloromethane	50923B	02/09/90	VOA	<5.00 E+00
Dichloromethane	50923T	02/09/90	VOA	<5.00 E+00
Hydrazine	50388	03/07/88	DIMS	<3.00 E+03
Hydrazine	50406	03/25/88	DIMS	<3.00 E+03
Hydrazine	50418	05/11/88	DIMS	<3.00 E+03
Hydrazine	50458	09/21/88	DIMS	<3.00 E+03
Hydrazine	50869	01/03/90	SPEC	<3.00 E+01
Hydrazine	50923	02/09/90	SPEC	8.80 E+01
Morpholine	50418	05/11/88	ABN	1.90 E+01
Trichloromethane	50388	03/07/88	VOA	9.00 E+00
Trichloromethane	50388B	03/07/88	VOA	1.10 E+01
Trichloromethane	50406	03/25/88	VOA	7.00 E+00
Trichloromethane	50406B	03/25/88	VOA	1.00 E+01
Trichloromethane	50418	05/11/88	VOA	2.00 E+01
Trichloromethane	50418B	05/11/88	VOA	5.00 E+00
Trichloromethane	50458	09/21/88	VOA	2.10 E+01
Trichloromethane	50458B	09/21/88	VOA	<5.00 E+00
Trichloromethane	50869	01/03/90	VOA	1.10 E+01
Trichloromethane	50869B	01/03/90	VOA	<3.00 E+00
Trichloromethane	50869T	01/03/90	VOA	<5.00 E+00
Trichloromethane	50923	02/09/90	VOA	1.10 E+01
Trichloromethane	50923B	02/09/90	VOA	<5.00 E+00
Trichloromethane	50923T	02/09/90	VOA	<5.00 E+00
Alkalinity (method B)	50869	01/03/90	TITRA	4.10 E+04
Alkalinity (method B)	50923	02/09/90	TITRA	3.70 E+04
Alpha activity (pCi/L)	50388	03/07/88	Alpha	2.19 E-02
Alpha activity (pCi/L)	50406	03/25/88	Alpha	4.47 E-01
Alpha activity (pCi/L)	50869	01/03/90	Alpha	<1.05 E-01
Beta activity (pCi/L)	50388	03/07/88	Beta	2.64 E+00
Beta activity (pCi/L)	50418	05/11/88	Beta	1.61 E-01
Beta activity (pCi/L)	50458	09/21/88	Beta	3.32 E+00
Beta activity (pCi/L)	50869	01/03/90	Beta	2.85 E+01
Conductivity (μS)	50388	03/07/88	COND-Fld	2.06 E+02
Conductivity (μS)	50406	03/25/88	COND-Fld	2.09 E+02
Conductivity (μS)	50418	05/11/88	COND-Fld	9.80 E+01
Conductivity (μS)	50458	09/21/88	COND-Fld	4.00 E+01
Conductivity (μS)	50869	01/03/90	COND-Fld	1.43 E+02
Conductivity (μS)	50923	02/09/90	COND-Fld	1.22 E+02
Ignitability (°F) ^b	50869E	01/03/90	IGNIT	2.12 E+02
Ignitability (°F) ^b	50923E	02/09/90	IGNIT	2.06 E+02
pH (dimensionless)	50388	03/07/88	PH-Fld	6.50 E+00

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 8 of 10)

Constituent	Sample number ^a	Sampling date	Method ^c	Result (ppb)
pH (dimensionless)	50406	03/25/88	PH-F1d	6.35 E+00
pH (dimensionless)	50418	05/11/88	PH-F1d	5.91 E+00
pH (dimensionless)	50458	09/21/88	PH-F1d	5.39 E+00
pH (dimensionless)	50869	01/03/90	PH-F1d	6.45 E+00
pH (dimensionless)	50923	02/09/90	PH-F1d	6.25 E+00
Reactivity cyanide (mg/kg)	50869E	01/03/90	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50923E	02/09/90	DSPEC	<1.00 E+02
Reactivity sulfide (mg/kg)	50869E	01/03/90	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50923E	02/09/90	DTITRA	<1.00 E+02
TDS	50869	01/03/90	TDS	3.60 E+04
TDS	50923	02/09/90	TDS	5.80 E+04
Temperature (°C)	50388	03/07/88	TEMP-F1d	1.68 E+01
Temperature (°C)	50406	03/25/88	TEMP-F1d	2.31 E+01
Temperature (°C)	50418	05/11/88	TEMP-F1d	2.01 E+01
Temperature (°C)	50458	09/21/88	TEMP-F1d	2.01 E+01
Temperature (°C)	50869	01/03/90	TEMP-F1d	2.23 E+01
Temperature (°C)	50923	02/09/90	TEMP-F1d	2.31 E+01
TOC	50418	05/11/88	TOC	1.65 E+03
TOC	50458	09/21/88	TOC	<7.00 E+02
TOC	50869	01/03/90	TOC	<1.60 E+03
TOC	50923	02/09/90	TOC	<1.40 E+03
Total carbon	50869	01/03/90	TC	1.68 E+04
Total carbon	50923	02/09/90	TC	1.40 E+04
TOX (as Cl)	50388	03/07/88	LTOX	4.46 E+01
TOX (as Cl)	50406	03/25/88	LTOX	7.60 E+01
TOX (as Cl)	50458	09/21/88	LTOX	5.00 E+01
TOX (as Cl)	50869	01/03/90	LTOX	4.80 E+01
TOX (as Cl)	50923	02/09/90	LTOX	3.80 E+01
¹³⁷ Cs (pCi/L)	50869	01/03/90	GEA	1.29 E+01

NOTE: Measurements are in ppb unless noted.

AA = atomic absorption spectroscopy

EP = Extraction Procedure Toxicity Test

GC = gas chromatography

ICP = inductively-coupled plasma spectroscopy

MS = mass spectrometry

TDS = total dissolved solids

TOC = total organic carbon

TOX = total organic halides

^aSee Table 3-1 for corresponding chain-of-custody number and explanations of number suffix.

^bIgnitability is the maximum temperature of the test (no sample actually ignited).

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Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 9 of 10)

cMethods code:		
Code	Analytical Method	Reference ^d
ABN	Semivolatile organics (GC/MS)	USEPA-8270
AEA	²⁴¹ Am	UST-20Am01
AEA	Curium isotopes	UST-20Am/Cm01
AEA	Plutonium isotopes	UST-20Pu01
AEA	Uranium isotopes	UST-20U01
ALPHA	Alpha counting	EPA-680/4-75/1
ALPHA-Ra	Total radium alpha counting	ASTM-D2460
BETA	Beta counting	EPA-680/4-75/1
BETA	⁹⁰ Sr	UST-20Sr02
COLIF	Coliform bacteria	USEPA-9131
COLIFMF	Coliform bacteria (membrane filter)	USEPA-9132
COND-Fld	Conductivity-field	ASTM-D1125A
COND-Lab	Conductivity-laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-mixed matrix	USEPA-7470
DIGC	Direct aqueous injection (GC)	UST-70DIGC
DIMS	Direct aqueous injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive cyanide (distillation, spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive sulfide (distillation, titration)	USEPA-CHAPTER 7
FLUOR	uranium (fluorometry)	ASTM-D2907-83
GEA	Gamma energy analysis spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, furnace technique)	USEPA-7060
GFAA	Lead (AA, furnace technique)	USEPA-7421
GFAA	Selenium (AA, furnace technique)	USEPA-7740
GFAA	Thallium (AA, furnace technique)	USEPA-7841
IC	Ion chromatography	EPA-600/4-84-01
ICP	Atomic emission spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic emission spectroscopy (ICP)-mixed matrix	USEPA-6010
IGNIT	Pensky-martens closed-cup ignitability	USEPA-1010
ISE	Fluoride-low detection limit	ASTM-D1179-80-B
ISE	Ammonium ion	ASTM-D1426-D
LALPHA	Alpha activity-low detection limit	EPA-680/4-75/1
LEPD	¹²⁹ I	UST-20I02
LSC	¹⁴ C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total organic halides-low detection limit	USEPA-9020
PH-Fld	pH-field	USEPA-9040
PH-Lab	pH-laboratory	USEPA-9040
SPEC	Total and amenable cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-low detection limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended solids	SM-208D
TC	Total carbon	USEPA-9060

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163N Demineralization Plant Wastewater

Table B-1. Sampling Data for the 163N Demineralization
Plant--Regenerate. (sheet 10 of 10)

^c Methods code: (cont.)		
Code	Analytical Method	Reference ^d
TDS	Total dissolved solids	SM-208B
TEMP-Fld	Temperature-field	Local
TITRA	Alkalinity-method B (titration)	ASTM-D1067B
TITRA	Sulfides (titration)	USEPA-9030
TOC	Total organic carbon	USEPA-9060
TOX	Total organic halides	USEPA-9020
VOA	Volatile organics (GC/MS)	USEPA-8240
^d Reference:		
ASTM	- <i>1986 Annual Book of ASTM Standards</i> , American Society for Testing and Materials, Philadelphia, Pennsylvania.	
EPA	- Various methods of the U.S. Environmental Protection Agency, Washington, D.C.	
UST	- Methods of the contract laboratory.	
SM	- <i>Standard Methods for the Examination of Water and Wastewater</i> , 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.	
USEPA	- <i>Test Methods for Evaluating Solid Waste Physical/Chemical Methods</i> , 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.	